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JEE (Main & Advanced) & PMTs

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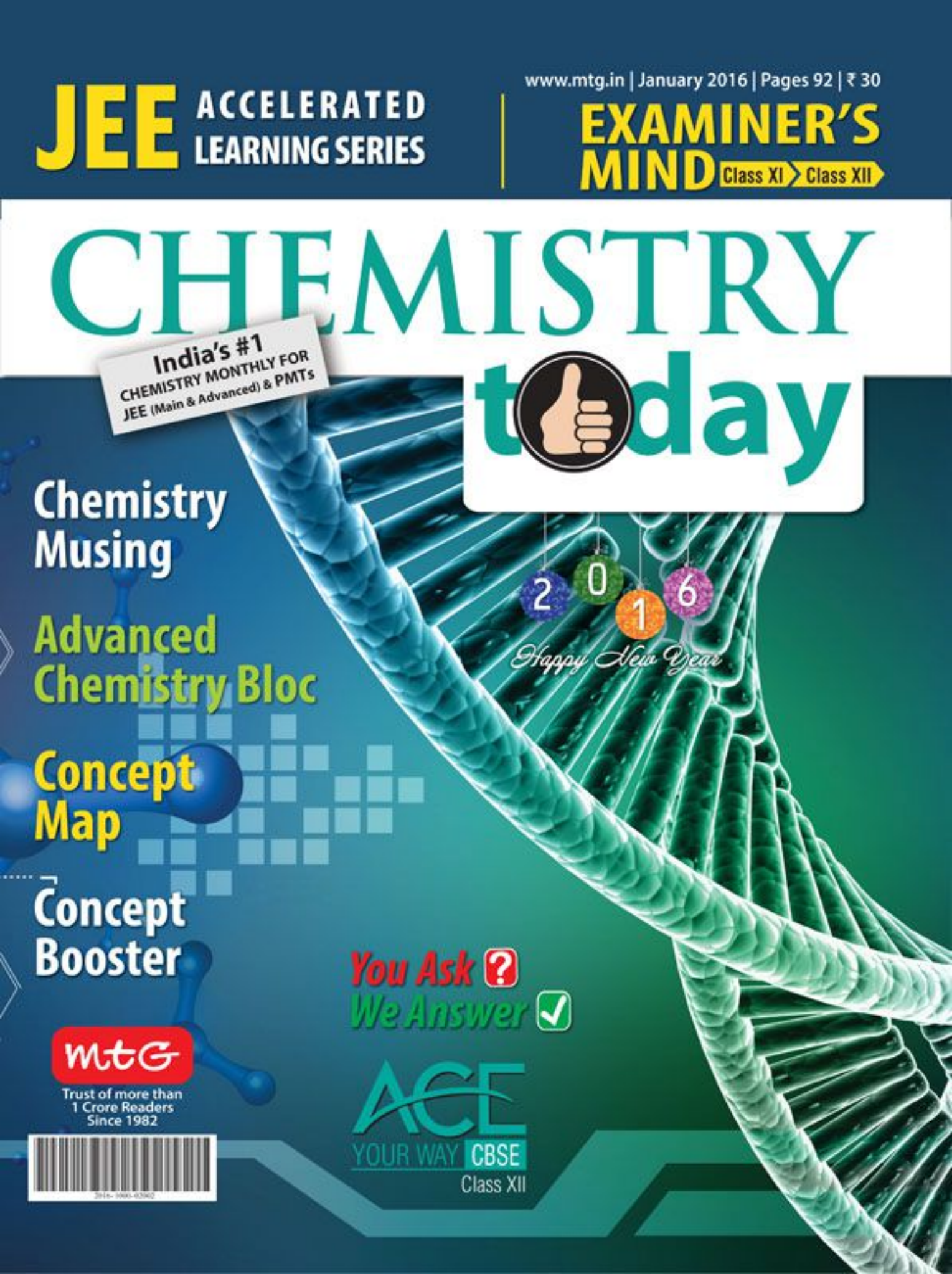

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Editor : Anil Ahlawat

CHEMISTRY MUSING

Chemistry Musing was started from August '13 issue of Chemistry Today with the suggestion of Shri Mahabir Singh. The aim of Chemistry Musing is to augment the chances of bright students preparing for JEE (Main and Advanced) / AIPMT / AIIMS / Other PMTs & PETs with additional study material.

In every issue of Chemistry Today, 10 challenging problems are proposed in various topics of JEE (Main and Advanced) / AIPMT. The detailed solutions of these problems will be published in next issue of Chemistry Today.

The readers who have solved five or more problems may send their solutions. The names of those who send atleast five correct solutions will be published in the next issue.

We hope that our readers will enrich their problem solving skills through "Chemistry Musing" and stand in better stead while facing the competitive exams.

PROBLEM Set 30

JEE MAIN/PMTs

1. The fact that two enantiomers of carvone have different smells suggests that

(a) the two enantiomers are associated with different impurity

(b) the two have different volatility

(c) the receptor sites in the nose are achiral

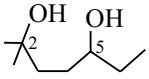
(d) the receptor sites in the nose are chiral.

2. The resonance energy of N_2O from the following data is (Given : ΔH_f° of N_2O is 82 kJ mol^{-1}).

$N \equiv N$	946 kJ mol^{-1}
$N = N$	418 kJ mol^{-1}
$O = O$	498 kJ mol^{-1}
$N = O$	607 kJ mol^{-1}

(a) -82 kJ mol^{-1} (b) $+88$ kJ mol^{-1}

(c) -88 kJ mol^{-1} (d) $+30$ kJ mol^{-1}

3. In the given diol 

(a) OH at C2 is more basic than at C5

(b) OH at C2 is more acidic than at C5

(c) both behave as a base

(d) both behave as an acid.

4. A solution containing 2.665 g of $CrCl_3.6H_2O$ (Mol. mass = 266.5 u) is passed through a cation exchanger. The chloride ions obtained in solution were treated with excess of $AgNO_3$ to give 2.87 g of AgCl. The structure of compound is

(a) $[Cr(H_2O)_6]Cl_3$

(b) $[CrCl_2(H_2O)_4]Cl{\cdot}2H_2O$

(c) $[CrCl(H_2O)_5]Cl_2{\cdot}H_2O$

(d) $[CrCl_3(H_2O)_3]{\cdot}3H_2O$

5. $CH_3-\overset{O}{\overset{\|}{C}}-CH_2-C\equiv CH \xrightarrow{HO\ OH} \xrightarrow[CH_3I]{NaNH_2} \xrightarrow{H^+} A$

A is

(a) $CH_3-\overset{O}{\overset{\|}{C}}-CH_2CH_2CH_2CH_3$

(b) $CH_3CH_2-\overset{O}{\overset{\|}{C}}-CH_2CH_2CH_3$

(c) $CH_3-\overset{O}{\overset{\|}{C}}-CH_2-C\equiv C-CH_3$

(d) $CH_3-\overset{O}{\overset{\|}{C}}-CH_2-CH=CH-CH_3$

JEE ADVANCED

6. A mixture of cinnamaldehyde and crotonaldehyde is treated with concentrated alkali,

$$C_6H_5\overset{\beta}{C}H=\overset{\alpha}{C}HCHO + \overset{\gamma}{C}H_3\overset{\beta}{C}H=\overset{\alpha}{C}HCHO \xrightarrow{OH^-}$$

Which of the following statements is true about the above reaction?

(a) Aldol condensation takes place and α-carbon atom of crotonaldehyde provides the carbanion.

(b) Aldol condensation takes place and β-carbon atom of crotonaldehyde provides the carbanion.

(c) Aldol condensation takes place and γ-carbon atom of crotonaldehyde provides the carbanion.

(d) Aldol condensation takes place and α-carbon atom of cinnamaldehyde provides the carbanion.

COMPREHENSION

When triatomic gas X_3 reacts with an excess of potassium iodide solution buffered with a borate buffer (pH = 9.2), diatomic product Y_2 is liberated which can be titrated against a standard solution of sodium thiosulphate. This is a quantitative method for the estimation of X_3 gas in the mixture of X_3 and X_2 of some atom X.

7. X_2 and Y_2 are respectively

(a) Cl_2, I_2 (b) O_2, I_2

(c) N_2, I_2 (d) O_2, H_2

8. Select the incorrect statement.

(a) Y_2 produces blue colour with starch.

(b) X_2 is thermodynamically more stable as compared to X_3.

(c) Y_2 can produce brown colouration due to the presence of excess KI.

(d) X_2 and X_3 both are colourless and odourless gases.

INTEGER VALUE

9. Neutron is a fundamental subatomic particle (mass = 1.675×10^{-27} kg) which is unstable in free state with half-life 700 seconds. A stream of neutrons has *K.E.* 5.2×10^{-21} J. This stream travels a distance of 100 m, the fraction of neutrons that will decay is 3.96×10^{-x}. The value of x is

10. The concentration of cation vacancies if NaCl is doped with 10^{-3} mole % of $SrCl_2$ is $x \times 10^{18}$. The value of x is

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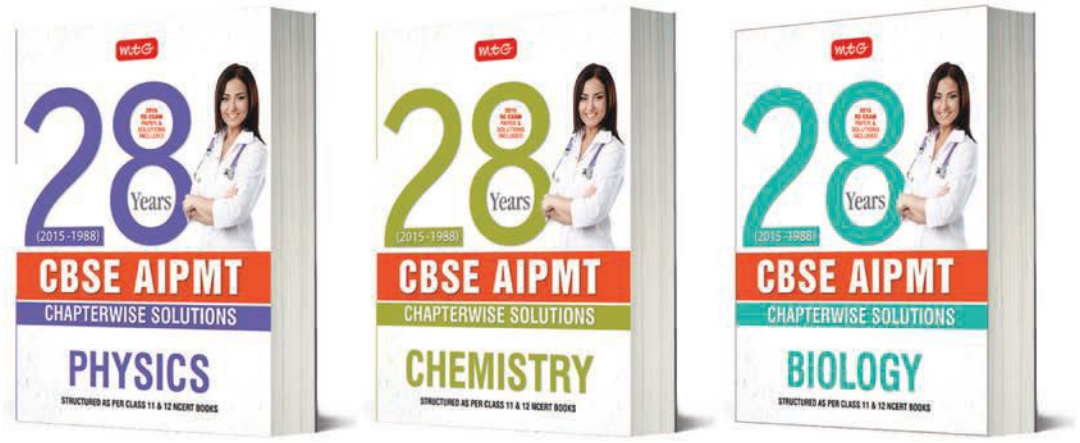

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28 Years' Physics, Chemistry & Biology contain not only chapterwise questions that have appeared over the last 28 years in CBSE's PMT, but also full solutions, that too by experts. Needless to say, these question banks are essential for any student to compete successfully in AIPMT. More so since almost 50% of questions in AIPMT are from previous years.

HIGHLIGHTS:

- Chapterwise questions of last 28 years' (2015-1988) of CBSE-PMT
- Chapterwise segregation of questions to help you assess the level of effort required to succeed
- An unmatched question bank series with close to 1,000 pages having detailed solutions by experts

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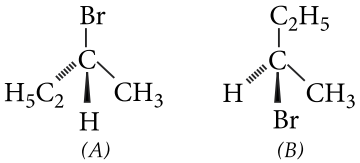
PRACTICE QUESTIONS *for* PMTs / PETs

Organic Chemistry

1. Electronegativity of carbon atoms depend upon their state of hybridisation. In which of the following compounds, the carbon marked with asterisk is most electronegative?

(a) $CH_3 - CH_2 - {}^*CH_2 - CH_3$
(b) $CH_3 - {}^*CH = CH - CH_3$
(c) $CH_3 - CH_2 - C \equiv {}^*CH$
(d) $CH_3 - CH_2 - CH = {}^*CH_2$

2. The addition of HBr to 1-butene gives a mixture of products *A*, *B* and *C*.



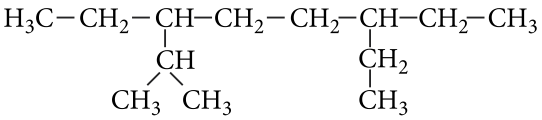
(A) *(B)*

$CH_3—CH_2—CH_2—CH_2—Br$
(C)

The mixture consists of

(a) *A* and *B* as major and *C* as minor products
(b) *B* as major, *A* and *C* as minor products
(c) *B* as minor, *A* and *C* as major products
(d) *A* and *B* as minor and *C* as major products.

3. The correct IUPAC name of the following alkane is

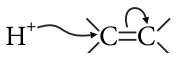


(a) 3,6-diethyl-2-methyloctane
(b) 5-*iso*-propyl-3-ethyloctane
(c) 3-ethyl-5-*iso*-propyloctane
(d) 3-*iso*-propyl-6-ethyloctane.

4. The principle involved in column chromatography is

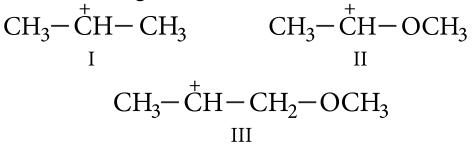
(a) adsorption (b) partition
(c) solubility (d) volatility.

5. The addition of HCl to an alkene proceeds in two steps. The first step is the attack of H^+ ion to $\rangle C=C\langle$ portion which can be shown as

(a)  (b) 

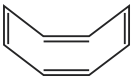
(c)  (d) all are possible.

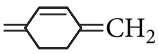
6. What is the correct order of decreasing stability of the following cations?



(a) II > I > III (b) II > III > I
(c) III > I > II (d) I > II > III

7. Which of the following is aromatic in nature?

(a)  (b) 

(c)  (d) H_2C= 

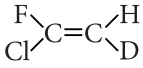
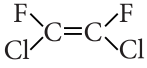
8. Carius method is used to calculate percentage of _____ in an organic compound.

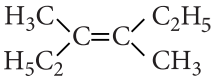
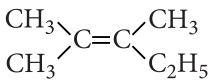
(a) nitrogen (b) phosphorous
(c) halogens (d) oxygen

9. By mistake, an alcohol (boiling point 97°C) was mixed with a hydrocarbon (boiling point 68°C). Method used to separate the two compounds is

(a) steam distillation
(b) distillation
(c) fractional distillation
(d) differential extraction.

10. Which of the following will not show geometrical isomerism?

(a)  (b) 

(c)  (d) 

11. During analysis of sodium extract (Lassaigne's test) for nitrogen, a student get blood red colour instead of prussian blue. This colour is due to the presence of

(a) chlorine (b) sulphur
(c) phosphorous (d) iodine.

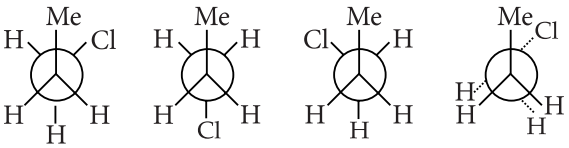
12. The most stable carbanion in the following is

(a) $\bar{C}H_3$ (b) $\bar{C}H_2Cl$
(c) $\bar{C}HCl_2$ (d) $\bar{C}Cl_3$

13. By using Wurtz reaction for the synthesis of alkanes, we always get

(a) odd number of carbons
(b) even number of carbons
(c) odd number of hydrogens
(d) none of these.

14. Chloropropane can show following conformational isomers.



(I) (II) (III) (IV)

Stable conformer among them is

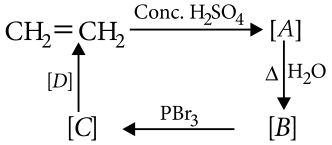
(a) II (b) III (c) I (d) IV

15. In a reaction given below, compound '*A*' is

$$HC \equiv CH \xrightarrow{2\text{ eq. HCl}} A$$

(a) $H_2C = CH - Cl$
(b) $Cl-CH = CH-Cl$
(c) $Cl-CH_2 - CH_2 - Cl$
(d) $H_3C - CHCl_2$

16. Identify *B* and *D* in the following sequence of reactions.

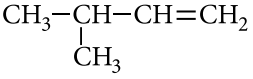
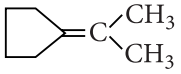


(a) Ethanol and alc. KOH
(b) Methanol and bromoethane
(c) Ethyl hydrogen sulphate and alc. KOH
(d) Ethyl hydrogen sulphate and aq. KOH

17. Hydration of alkenes take place in

(a) acidic medium (b) basic medium
(c) both (a) and (b) (d) none of these.

18. Which of the following alkenes on ozonolysis gives a mixture of ketones only?

(a) $CH_3 - CH = CH - CH_3$
(b) 
(c)  (d) $H_2C = CH_2$

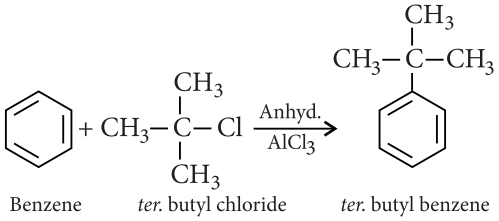
19. *n*-Pentane and *iso*-pentane can be distinguished by

(a) Br_2 (b) O_3
(c) Conc. H_2SO_4 (d) $KMnO_4$

20. During analysis for halogens, the halide ion which cannot be detected by $AgNO_3$ solution is

(a) F^- (b) Cl^-
(c) Br^- (d) I^-

21. In the given reaction, the intermediate formed and name of the reaction is



Benzene *ter.* butyl chloride *ter.* butyl benzene

(a) radical, Friedel – Crafts alkylation
(b) carbanion, Friedel – Crafts acylation
(c) carbocation, Friedel – Crafts alkylation
(d) nucleophile, Friedel – Crafts acylation.

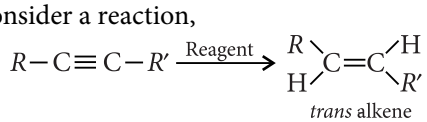
22. Which of the following reactions is the incomplete combustion of methane?

(a) $2CH_4 + O_2 \xrightarrow{\text{Cu/523 K/100 atm}} 2CH_3OH$
(b) $CH_4 + O_2 \xrightarrow{Mo_2O_3} HCHO + H_2O$
(c) $CH_4 + O_2 \longrightarrow C + 2H_2O$
(d) $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

23. The hybridisation state of carbon and nitrogen respectively in a given compound $CH_3 - NO_2$ is

(a) sp^3, sp^2 (b) sp^2, sp^2
(c) sp, sp^2 (d) sp^3, sp^3

24. Consider a reaction,

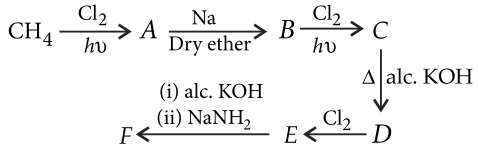


trans alkene

the appropriate reagent is

(a) Lindlar's catalyst (b) Na in liq. NH_3
(c) H_2 in Pd/C (d) H_2 in raney Ni.

25. Consider the given reactions sequence :



Compound *F* is

(a) $CH_3 - CH_3$ (b) $CH_2 = CH_2$

(c) $CH \equiv CH$ (d) $Cl - CH_2 - CH_2 - Cl$

26. The increasing order of reduction of alkyl halides with zinc and dilute HCl is

(a) *R* — Cl < *R* — I < *R* — Br

(b) *R* — Cl < *R* — Br < *R* — I

(c) *R* — I < *R* — Br < *R* — Cl

(d) *R* — Br < *R* — I < *R* — Cl

27. On complete combustion, 0.246 g of an organic compound gave 0.198 g of carbon dioxide and 0.1014 g of water. Percentage composition of carbon and hydrogen is

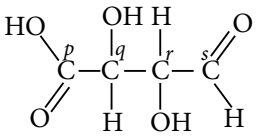
(a) C = 4.58%, H = 12.60%

(b) C = 56.30%, H = 3.08%

(c) C = 15.46%, H = 4.58%

(d) C = 21.95%, H = 4.58%.

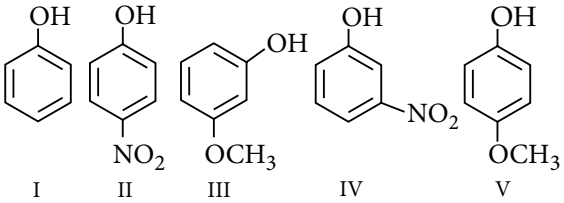
28. Which of the carbon atoms present in the given molecule are asymmetric?



(a) *p*, *q*, *r*, *s* (b) *q*, *r*

(c) *p*, *s* (d) *p*, *q*, *r*

29. Mark the correct order of decreasing acidic strength of the following compounds.



(a) V > IV > II > I > III (b) II > IV > III > I > V

(c) IV > V > III > II > I (d) V > IV > III > II > I

30. $CH_3OC_2H_5$ and $(CH_3)_3COCH_3$ are treated with hydroiodic acid. The fragments obtained after reaction are

(a) $CH_3I + C_2H_5OH$; $(CH_3)_3C—I + CH_3OH$

(b) $CH_3OH + C_2H_5I$; $(CH_3)_3C—I + CH_3OH$

(c) $CH_3OH + C_2H_5I$; $(CH_3)_3C—OH + CH_3I$

(d) $CH_3I + C_2H_5OH$; $CH_3I + (CH_3)_3C—OH$

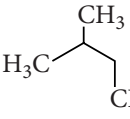
31. Reaction of $C_6H_5CH_2Br$ with aqueous sodium hydroxide follows

(a) S_N1 mechanism

(b) S_N2 mechanism

(c) any of the above two depending upon the temperature of reaction

(d) Saytzeff rule

32. 

$\xrightarrow{Cl_2, h\upsilon}$ $C_5H_{11}Cl$ (*N* number of isomeric products)

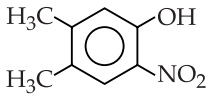
$\xrightarrow[\text{distillation}]{\text{Fractional}}$ (*M* number of isomeric products)

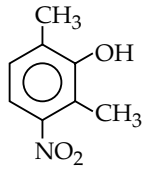
N and *M* are respectively

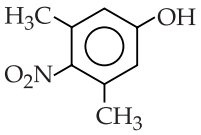
(a) 6, 6 (b) 6, 4

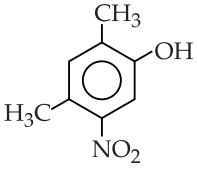
(c) 4, 4 (d) 7, 3

33. Which one of the following nitrophenols is the strongest acid?

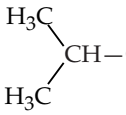
(a) 

(b) 

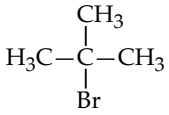
(c) 

(d) 

34. Arrange the following compounds in increasing order of their boiling points.

P. 

Q. $CH_3CH_2CH_2CH_2Br$

R. 

(a) *Q* < *P* < *R* (b) *P* < *Q* < *R*

(c) *R* < *P* < *Q* (d) *R* < *Q* < *P*

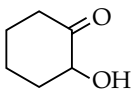
35. The conversion of ethanol to propane nitrile (CH_3CH_2CN) is best carried out by

(a) $CH_3CH_2OH + KCN \xrightarrow{\Delta}$

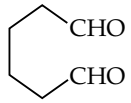
(b) $CH_3CH_2OH + HCN \xrightarrow{\Delta}$

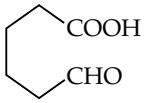
(c) $CH_3CH_2OH \xrightarrow[\text{Pyr.}]{\text{TsCl}} CH_3CH_2OTs \xrightarrow{KCN}$

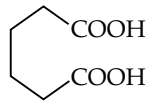
(d) $CH_3CH_2OH + CH_3CN \xrightarrow{\Delta}$

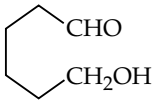
36. The product obtained when 

is oxidised with HIO_4 is

(a) 

(b) 

(c) 

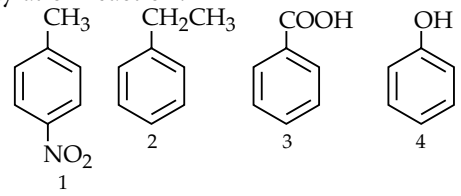
(d) 

37. Match the List I with List II and select the correct answer using the code given below the lists :

	List I		List II
P.	Reacts fastest with Lucas reagent	1.	CH_3CH_2OH
Q.	Get easily oxidised by $K_2Cr_2O_7/H_2SO_4$	2.	$CH_3CH_2CHOHCH_3$
R.	Produces blue colouration in Victor Meyer's test	3.	C_6H_5OH
S.	Produces violet colouration with neutral $FeCl_3$	4.	$(CH_3)_3COH$

	P	Q	R	S
(a)	1	4	3	2
(b)	4	1	2	3
(c)	2	3	1	4
(d)	1	2	4	1

38. Which of the following will undergo Friedel–Crafts alkylation reaction?



(a) 1, 2 and 4 (b) 1 and 3
(c) 2 and 4 (d) 1 and 2

39. Which of the following alkyl halides when subjected to dehydrohalogenation by the action of ethanolic KOH would yield $CH_3CH=C(CH_3)_2$ as the major product?

(a) $CH_3—CHBr—CH(CH_3)_2$
(b) $CH_3CH_2CH(CH_3)—CH_2Br$
(c) $CH_3CH_2CHBrCH_2CH_3$
(d) $CH_3CHBrCH_2CH_2CH_3$

40. Which of the following is an example of S_N2 reaction?

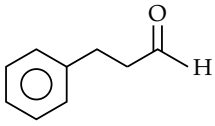
(a) $CH_3Br + OH^- \longrightarrow CH_3OH + Br^-$

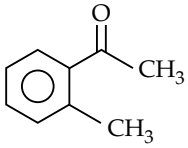
(b) $CH_3—\underset{\displaystyle Br}{\underset{|}{CH}}—CH_3 + OH^- \longrightarrow CH_3—\underset{\displaystyle OH}{\underset{|}{CH}}—CH_3 + Br^-$

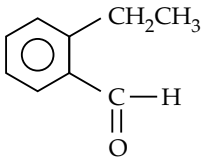
(c) $CH_3CH_2OH \xrightarrow{-H_2O} CH_2=CH_2$

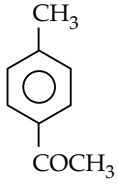
(d) $(CH_3)_3C—Br + OH^- \longrightarrow (CH_3)_3C—OH + Br^-$

41. An organic compound with the molecular formula $C_9H_{10}O$ forms 2, 4-DNP derivative, reduces Tollens' reagent and undergoes Cannizzaro reaction. On vigorous oxidation, it gives benzene-1, 2-dicarboxylic acid. Identify the compound.

(a) 

(b) 

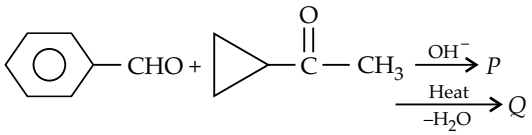
(c) 

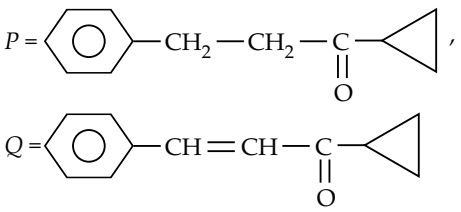
(d) 

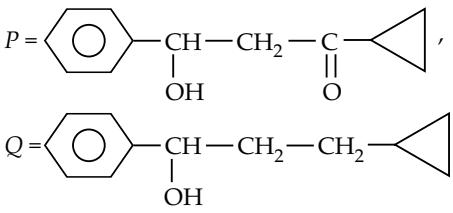
42. The correct statement about protein haemoglobin is that it

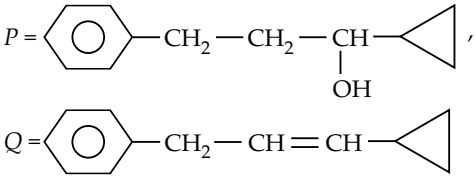
(a) acts as an oxygen carrier in the blood
(b) forms antibodies and offers resistance to diseases
(c) functions as a catalyst for biological reactions
(d) maintains blood sugar level.

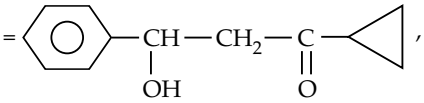
43. Identify *P* and *Q* in the following reaction.

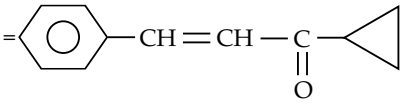


(a) 

(b) 

(c) 

(d) $P =$ 

$Q =$ 

44. Which of the following substances is used as an antiseptic as well as a disinfectant?

(a) Iodine (b) H_2O_2

(c) Phenol (d) Dettol

45. Match the vitamins in List I with their chemical names in List II and select the correct answer using the code given below the lists :

	List I		**List II**
P.	Vitamin B_6	1.	Pyridoxine
Q.	Vitamin B_2	2.	Ascorbic acid
R.	Vitamin K	3.	Phylloquinone
S.	Vitamin C	4.	Riboflavin

	P	**Q**	**R**	**S**
(a)	1	4	2	3
(b)	2	3	4	1
(c)	3	2	1	4
(d)	1	4	3	2

46. Identify the incorrect statement.

(a) Bakelite and urea-formaldehyde resins are elastomers.

(b) Polyamides like nylon 6, nylon 6,6 are the examples of fibres.

(c) Polystyrene, polyvinyl and polythene are thermoplastic polymers.

(d) Thermoplastic polymers have intermolecular forces in between elastomers and fibres.

47. Naturally occurring sugars and amino acids have configuration respectively,

(a) *L*-sugars, *D*-amino acids

(b) *D*-sugars, *D*-amino acids

(c) *D*-sugars, *L*-amino acids

(d) *L*-sugars, *L*-amino acids.

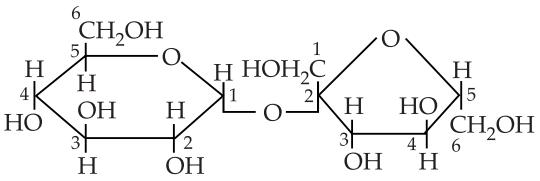
48. Identify the sequence of bases of *m*RNA molecule synthesised on the given strand of DNA.

AGCGATTAC

(a) ACGCATTAG (b) TGGCTAATG

(c) UCGCUAAUG (d) UCGCUTTUC

49. Structure of a disaccharide formed by glucose and fructose is given. Identify anomeric carbon atoms in monosaccharide units.



(a) '1' carbon of glucose and '1' carbon of fructose.

(b) '1' carbon of glucose and '5' carbon of fructose.

(c) '1' carbon of glucose and '2' carbon of fructose.

(d) '6' carbon of glucose and '6' carbon of fructose.

50. Consider the following statements.

(I) Antibiotics which kill the microorganisms are known as bactericidal drugs.

(II) Antibiotics which inhibit the growth of microorganisms are known as bacteriostatic drugs.

(III) Penicillin is a broad spectrum antibiotic.

Correct statements are

(a) (II) and (III) (b) (I), (II) and (III)

(c) (I) and (II) (d) (I) and (III)

SOLUTIONS

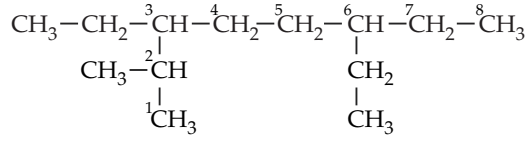
1. **(c) :** More the *s*-character in hybridisation, more the atom is electronegative. So, electronegativity follows the order :

	sp	>	sp^2	>	sp^3
s-character	50%		33%		25%

2. **(a) :** According to Markovnikov's rule, 1-butene reacts with HBr to give 2-bromobutane.

$$CH_3-CH_2-CH=CH_2 \xrightarrow{HBr} CH_3-CH_2-\underset{\displaystyle Br}{\underset{|}{CH}}-CH_3$$

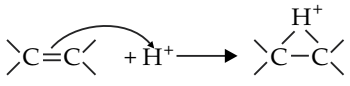
But bromine can attack *via* two sides, from up and down and hence will give two isomers (*A*) and (*B*) as major products.

3. **(a) :** 

3,6-Diethyl-2-methyloctane

4. **(a) :** Column chromatography is a type of adsorption chromatography.

5. **(b) :** Addition of HCl to an alkene follows Markovnikov's rule and first step is the capture of proton by electron cloud of π-bond.



6. (a) : $CH_3 \rightarrow \overset{+}{C}H \leftarrow CH_3$ (I) $\quad CH_3-\overset{+}{C}H-\ddot{O}-CH_3$ (II)

Stabilised by weak +*I* effect of the two methyl groups

Stabilised by strong +*R* effect of the $-OCH_3$ groups

$CH_3-\overset{+}{C}H \rightarrow CH_2 \rightarrow OCH_3$ (III)

Destabilised by –*I* effect of the $-OCH_3$ group

Thus, the stability of carbocations decreases in the order : II > I > III.

7. (c) : In (a), although it is cyclic and has conjugated 8π-electrons but Huckel's $(4n + 2)\pi$ rule does not hold good and ring is also not planar.
In (b), it follows Huckel's rule *i.e.,* 2π-electrons but due to the presence of extra lone pair of electrons total e^- comes out to be 4π. It is anti-aromatic.
In (c), it follows Huckel's rule and due to the presence of the charge, the molecule is aromatic.
In (d), it has 6π-electrons in conjugation but not in the ring, hence it is also non-aromatic.

8. (c)

9. (b) : Simple distillation can be used because these two compounds have a difference of more than 20°C in their boiling points and can be distilled out without any decomposition.

10. (d) : Geometrical isomerism is shown by the molecules that have atleast two different groups across the double bond.

11. (b) : If both sulphur and nitrogen are present in an organic compound, sodium thiocyanate is formed which gives blood red colour instead of prussian blue.

$Na + C + S + N \longrightarrow NaSCN \xrightarrow{Fe^{3+}} [Fe(SCN)]^{2+}$

Blood red colour

12. (d) : $\bar{C}-Cl_3$ is most stable because electro-negativity of chlorine is more than hydrogen. On replacing hydrogen by chlorine, negative charge on carbon is reduced and species is stabilised.

13. (b) : In Wurtz reaction, we always get even number of carbons in alkanes synthesis.

$2R-X + 2Na \xrightarrow[ether]{Dry} R-R + 2NaX$

14. (a) : In this conformation, the dihedral angle between methyl and chlorine atom is maximum and hence it is most stable.

15. (d) : Alkynes react with hydrogen halide giving gem dihalide as a product.

$HC\equiv CH + HCl \longrightarrow H_2C=CH-Cl \xrightarrow{HCl} CH_3-CH(Cl)_2$

16. (a) : $CH_2=CH_2 \xrightarrow{H^+HSO_4^-} CH_3CH_2HSO_4$ (*A*)

$\xrightarrow[\Delta]{H_2O}$ HO–CH_2–CH_3 (*B*) $\xrightarrow{PBr_3}$ Br–CH_2–CH_3 (*C*)

(*C*) $\xrightarrow{\text{alc. KOH}}$ (*D*) $CH_2=CH_2$

17. (a) : Hydration of alkenes takes place in acidic medium. *e.g.*,

$R-CH=CH-R' \xrightarrow[H_2O]{H_2SO_4 \text{ (Conc.)}} R-CH_2-\underset{OH}{CH}-R'$

18. (c) : Only compound (c) will give ketone on ozonolysis, others will give mixture of aldehydes.

$(H_3C)_2C=C(CH_3)_2 \xrightarrow{O_3}$ Ozonide $\xrightarrow[-ZnO]{Zn \text{ dust}/H_2O_2} =O + (H_3C)_2C=O$

19. (d) : On oxidation with $KMnO_4$, they can be distinguished.

$CH_3-CH_2-CH_2-CH_2-CH_3 \xrightarrow[[O]]{KMnO_4}$ No reaction

n-pentane

$CH_3-CH_2-\underset{CH_3}{CH}-CH_3 \xrightarrow[[O]]{KMnO_4} CH_3-CH_2-\underset{CH_3}{\overset{OH}{C}}-CH_3$

iso-pentane — 3° alcohol

20. (a) : F^- ion do not give any precipitate when treated with $AgNO_3$ solution in sodium extract.

21. (c) : In the given reaction, carbocation is formed as an intermediate and the reaction is Friedel-Crafts alkylation.

In step - I : $(CH_3)_3C-Cl + AlCl_3$ (anhyd.) $\rightleftharpoons (CH_3)_3C^+ + AlCl_4^-$

In step - II : $C_6H_6 + (CH_3)_3C^+ \longrightarrow C_6H_5-C(CH_3)_3$

22. (c) : During incomplete combustion of alkanes with insufficient amount of air or dioxygen, carbon black is formed.

23. (a)

24. (b) : Reduction of alkyne with Na in liq. NH_3 gives *trans*-alkene only. This reduction is called Birch reduction.

25. (c) : Compound *F* is acetylene, HC ≡ CH.

$$CH_4 \xrightarrow[h\upsilon]{Cl_2} \underset{(A)}{CH_3-Cl} \xrightarrow[\text{Dry ether}]{2\,Na} \underset{(B)}{CH_3-CH_3} \xrightarrow[h\upsilon]{Cl_2}$$

$$\underset{(C)}{CH_3-CH_2-Cl} \xrightarrow{\text{alc. KOH}} \underset{(D)}{CH_2=CH_2} \xrightarrow{Cl_2}$$

$$\underset{\underset{Cl}{|}\quad\underset{Cl}{|}}{\underset{(E)}{CH_2-CH_2}} \xrightarrow{\text{(i) alc. KOH}} H_2C=CH-Cl \xrightarrow{\text{(ii) } NaNH_2} \underset{(F)}{HC\equiv CH}$$

26. (b)

27. (d): Percentage of carbon $= \dfrac{12\times0.198\times100}{44\times0.246}$

$= 21.95\%$

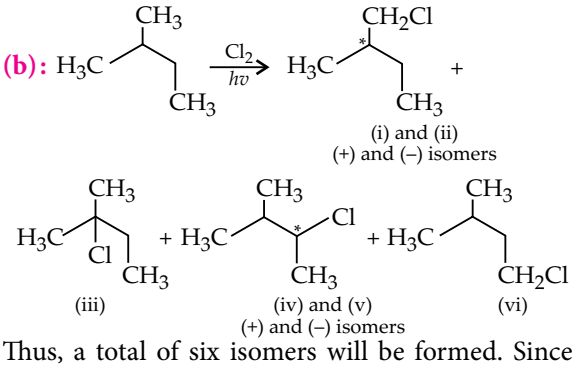
Percentage of hydrogen $= \dfrac{2\times0.1014\times100}{18\times0.246} = 4.58\%$

28. (b) **29. (b)**

30. (a) : In $CH_3OC_2H_5$, attack of I^- ion occurs at CH_3 group giving CH_3I and C_2H_5OH. In contrast, in $(CH_3)_3COCH_3$, reaction occurs by S_N1 mechanism and I^- ion attacks the more stable $(CH_3)_3C^+$ giving $(CH_3)_3CI$ and CH_3OH.

31. (a) : $C_6H_5\overset{+}{C}H_2$ is stable carbocation so favours the progress of reaction by S_N1 mechanism.

32. (b):



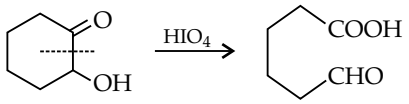
Thus, a total of six isomers will be formed. Since enantiomers have same b.pt., they can not be separated by fractional distillation, *i.e.*, (i) and (ii) will distill together and similarly (iv) and (v) will distill together. Thus, out of six isomers formed, four can be separated by fractional distillation.

33. (a) : *o*-and *p*-nitrophenols are stronger acids than *m*-nitrophenol. As a result, nitrophenols (a) and (c) are stronger acids than (b) and (d). In (c), the $-NO_2$ group is flanked by two $-CH_3$ groups which push the $-NO_2$ group out of the plane of the benzene ring. As a result of this steric hindrance the electron withdrawing resonance effect of the nitro group will be reduced (also called steric inhibition resonance) and hence the acidic character of the nitrophenol will decreases. Therefore, nitrophenol (a) is the strongest acid.

34. (c)

35. (c) : Reactions (a), (b) and (d) have a poor leaving group *i.e.*, —OH and hence reaction can not occur. Reaction (c), has a good leaving group, *i.e.*, OTs and hence nucleophilic substitution by CN^- occurs easily.

36. (b):



37. (b)

38. (c) : $-CH_2CH_3$ and $-OH$ groups being electron donating groups increase the electron density in the benzene ring and thus favour Friedel–Crafts alkylation.

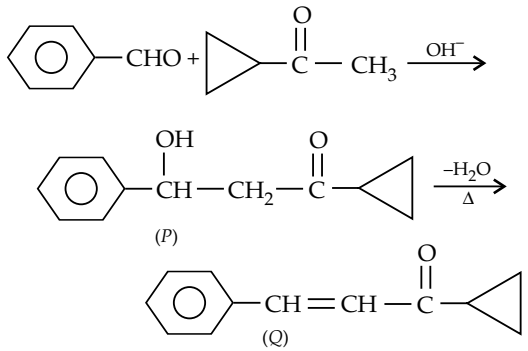
39. (a) : $CH_3—CHBr—CH(CH_3)_2 \xrightarrow{KOH/EtOH} CH_3CH=C(CH_3)_2$

40. (a)

41. (c) : The compound gives positive Tollens' test, it indicates the presence of —CHO group but without α-hydrogen (because it gives positive Cannizzaro reaction). Thus, the compound is 2-ethylbenzaldehyde.

42. (a) : Haemoglobin carries oxygen from lungs to the tissues.

43. (d):



44. (c) : 0.2% solution of phenol acts as an antiseptic and its 1% solution is disinfectant.

45. (d)

46. (a) : Bakelite and urea-formaldehyde resins are the examples of thermosetting polymers.

47. (c)

48. (c) : In *m*RNA molecule, complementary bases are

$A \rightarrow U, \quad G \rightarrow C; \quad C \rightarrow G, \quad T \rightarrow A$

$\therefore$ sequence is AGCGATTAC

UCGCUAAUG

49. (c) : C_1 in glucose and C_2 in fructose are the anomeric carbon atoms.

50. (c)

PRACTICE PAPER

PMT

CLASS XII

*Dr. Sangeeta Khanna

SINGLE OPTION CORRECT

This paper contains 45 **multiple choice questions**. Each question has four choices (a), (b), (c) and (d), out of which **ONLY ONE** is correct. (Mark only One Choice).

Marks : 45×4=180 **Negative Marking (–1)**

1. Equivalent conductivity of $Fe_2(SO_4)_3$ is related to molar conductivity by the expression

(a) $\Lambda_{eq} = \Lambda_m$ (b) $\Lambda_{eq} = \frac{\Lambda_m}{3}$

(c) $\Lambda_{eq} = 3\Lambda_m$ (d) $\Lambda_{eq} = \frac{\Lambda_m}{6}$

2. Unit of frequency factor A in $k = Ae^{-E_a/RT}$ is

(a) time^{-1}

(b) mole litre^{-1} time^{-1}

(c) litre mole^{-1} time^{-1}

(d) dependent on order of reaction.

3. In which case should $N_{2(g)}$ be more soluble in water?

(a) The total pressure is 5 atm and the partial pressure of N_2 is 1 atm.

(b) The total pressure is 1 atm and the partial pressure of N_2 is 0.03 atm.

(c) The total pressure is 1 atm and the partial pressure of N_2 is 0.5 atm.

(d) The total pressure is 3 atm and the partial pressure of N_2 is 2 atm.

4. The van't Hoff factor for a 0.1 M $Al_2(SO_4)_3$ solution is 4.20. The degree of dissociation is

(a) 80% (b) 90% (c) 78% (d) 83%

5. For the reaction $2A + B + C \longrightarrow A_2B + C$, the rate = $k[A]\,[B]^2$ with $k = 2.0 \times 10^{-6}$ mol^{-2} L^2 s^{-1}. Initial concentrations are $[A]$ = 0.1 M, $[B]$ = 0.2 M and $[C]$ = 0.8 M. If the rate of reverse reaction is negligible then, what will be the rate of reaction after $[A]$ is reduced to 0.06 M?

(a) 3.89×10^{-9} mol L^{-1} s^{-1}

(b) 7.6×10^{-9} mol L^{-1} s^{-1}

(c) 1.25×10^{-9} mol L^{-1} s^{-1}

(d) 6×10^{-6} mol L^{-1} s^{-1}

6. Given that $E^\circ_{Zn^{2+}/Zn} = -0.763$ V and $E^\circ_{Cd^{2+}/Cd} = -0.40$ V, the emf of the cell Zn $|\ \underset{(0.004\,M)}{Zn^{2+}}\ ||\ \underset{(0.2\,M)}{Cd^{2+}}\ |$ Cd will be given by

(a) $E = -0.36 + (0.059/2) \log (0.004/2)$

(b) $E = +0.36 + (0.059/2) \log (0.004/2)$

(c) $E = -0.36 + (0.059/2) \log (0.2/0.004)$

(d) $E = +0.36 + (0.059/2) \log (0.2/0.004)$

7. When ammonia gas is brought in contact with water surface, its pressure falls due to

(a) physical adsorption

(b) chemical adsorption

(c) absorption

(d) none of the above.

8. When a solution of $AgNO_3$ (1 M) is electrolysed using platinum anode and copper cathode. What are the products obtained at two electrodes?

Given :

$E^\circ_{Cu^{2+}|Cu} = +0.34$ volt ; $E^\circ_{O_2|H^+|H_2O} = +1.23$ volt ;

$E^\circ_{H^+|H_2} = +0.0$ volt ; $E^\circ_{Ag^+|Ag} = +0.8$ volt

(a) $Cu \rightarrow Cu^{2+}$ at anode; $Ag^+ \rightarrow Ag$ at cathode

(b) $H_2O \rightarrow O_2$ at anode; $Cu^{2+} \rightarrow Cu$ at cathode

(c) $H_2O \rightarrow O_2$ at anode; $Ag^+ \rightarrow Ag$ at cathode

(d) $NO_3^- \rightarrow NO_2$ at anode; $Ag^+ \rightarrow Ag$ at cathode

9. Consider the following reactions :

$Cd^{2+}_{(aq)} + 2e^- \longrightarrow Cd_{(s)}$, $E^\circ = -0.40$ V

$Ag^+_{(aq)} + e^- \longrightarrow Ag_{(s)}$, $E^\circ = 0.80$ V

Which of the following statements is not correct for the galvanic cell involving the above reactions?

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(a) E_{cell} increases when Cd^{2+} solution is diluted.
(b) E_{cell} decreases when Ag^{+} solution is diluted.
(c) Twice as many electrons pass through the cadmium electrode as through silver electrode.
(d) Molar concentration of the cation in the cathodic compartment changes faster than that of the cation in anodic compartment.

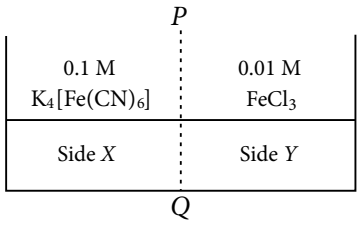
10. Using electrolytic method, the cost of production of 5 L of oxygen at STP, is Rs. X, the cost of production of same volume of hydrogen at STP, will be

(a) $2X$ (b) $\frac{X}{2}$ (c) $8X$ (d) $\frac{X}{8}$

11. If the radii of A^{+} and B^{-} in the crystalline solid AB are 96 pm and 200 pm respectively. The type of voids occupied is

(a) trigonal (b) octahedral
(c) hexagonal (d) cubic.

12.



PQ is semipermeable membrane. Due to osmosis there is

(a) blue colour formation in side X
(b) blue colour formation in side Y
(c) blue colour formation in both sides X and Y
(d) no blue colour formation.

13. For spontaneous adsorption of a gas on solid surface in an exothermic process

(a) ΔH increases for system
(b) ΔS increases for gas
(c) ΔS decreases for gas
(d) ΔG increases for gas.

14. Freundlich adsorption isotherm gives a straight line on plotting

(a) $\frac{x}{m}$ vs P (b) $\log\left(\frac{x}{m}\right)$ vs P

(c) $\log\left(\frac{x}{m}\right)$ vs $\log P$ (d) $\frac{x}{m}$ vs $\frac{1}{P}$

15. Which sequence decides the mechanism of sequence of heterogeneous catalysis?

(a) Adsorption of gases → diffusion → formation of loose chemical combination with the catalyst → chemical reaction → desorption of reaction products
(b) Diffusion of gases → adsorption → loose chemical combination with catalyst → chemical reaction → desorption of reaction products
(c) Chemical combination with catalyst → diffusion of gases → adsorption → chemical reaction → desorption of reaction products
(d) Both (a) and (c)

16. Which of the following is not a macromolecular colloids?

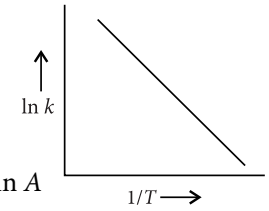
(a) Starch (b) Rubber
(c) Detergent (d) Cellulose

17. Select the incorrect statement among the following.

(a) At 83 K, N_2 is physisorbed on the surface of iron.
(b) At 773 K and above, N_2 is chemisorbed on the iron surface.
(c) Activation energy is positive in case of physisorption and zero in case of chemisorption.
(d) Activation energy is zero in case of physisorption and positive in case of chemisorption.

18. The temperature dependency of reaction is represented by the Arrhenius equation :

$$\ln k = -\frac{E_a}{RT} + \ln A$$



Which of the following conclusions is wrong about the given plot?

(a) Intercept of the line $= \ln A$
(b) Slope of the line $= -\frac{E_a}{R}$
(c) Reaction with high activation energy is more temperature sensitive than that of low activation energy (E_a).
(d) Slope $= -\frac{E_a}{RT}$

19. Which of the following factors is responsible for the decrease in the rate of a surface catalysed reaction?

(a) A catalyst provides proper orientation for the reactant molecules to react.
(b) Heat of adsorption of reactants on a catalyst helps reactant molecules to overcome activation energy.
(c) The catalyst increases the activation energy of the reaction.
(d) Adsorption increases the local concentration of reactant molecules on the surface of the catalyst.

20. To observe the effect of concentration on the conductivity, electrolytes of different nature were taken into two vessels *A* and *B*. '*A*' contains weak electrolyte, NH_4OH and '*B*' contains strong electrolyte NaCl. In both the containers *A* and *B*, concentration of respective electrolyte was increased and the conductivities observed as

(a) in '*A*' increases while in '*B*' decreases
(b) in '*A*' decreases while in '*B*' increases
(c) in both '*A*' and '*B*' increases
(d) in both '*A*' and '*B*' decreases.

21. $MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O$; $E^\circ = 1.51$ V

$MnO_2 + 4H^+ + 2e^- \longrightarrow Mn^{2+} + 2H_2O$; $E^\circ = 1.23$ V

$E^\circ_{MnO_4^-|MnO_2}$ is

(a) 1.70 V (b) 0.91 V
(c) 1.37 V (d) 0.548 V

22. The equivalent conductance at infinite dilution of a weak acid such as HF

(a) can be determined by extrapolation of measurements on dilute solutions of HCl, HBr and HI
(b) can be determined by measurement of very dilute HF solution
(c) can best be determined from measurements of concentrated solutions of NaF, NaCl and HCl
(d) can best be determined from measurements of dilute solutions of NaF, NaCl and HCl.

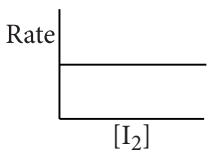
23. The charge required for the oxidation of one mole Mn_3O_4 into MnO_4^{2-} in presence of alkaline medium is

(a) 5×96500 C (b) 96500 C
(c) 10×96500 C (d) 2×96500 C

24. A quantity of iodine was reacted with a large excess of propanone and dilute acid. The equation for the reaction was

$I_2 + CH_3COCH_3 \longrightarrow ICH_2COCH_3 + HI$

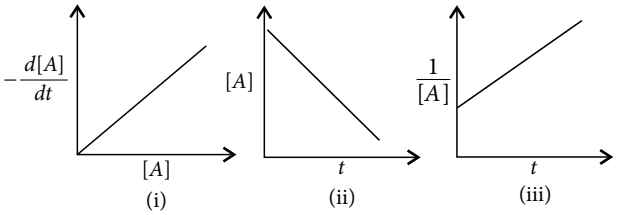
The concentration of iodine in the reaction mixture was recorded at regular time intervals and the result is shown in figure.



Which one of the following deductions can be made from this graph?

(a) The rate of reaction is directly proportional to $[I_2]$.
(b) The rate of reaction is inversely proportional to $[I_2]$.
(c) The rate of reaction is independent of $[I_2]$.
(d) The rate of reaction is independent of $[H^+]$.

25. Consider the plots for the types of reaction : $nA \longrightarrow B + C$



These plots respectively correspond to the reaction orders

(a) 0, 2, 1 (b) 0, 1, 2
(c) 1, 1, 2 (d) 1, 0, 2

26. Intermolecular forces in liquid *A* are considerably larger than intermolecular forces in liquid *B*. Which of the following properties is not expected to be larger for *A* than *B*?

(a) The vapour pressure at 20 °C
(b) The temperature at which the vapour pressure is 100 mm Hg
(c) The critical temperature
(d) The heat of vaporisation (ΔH_{vap})

27. Ba^{2+}, CN^- and Co^{2+} ions form an ionic complex. If this complex is 75% ionised in aqueous solution with van't Hoff's factor equal to four. What will be the molecular formula of complex?

(a) $Ba_2[Co(CN)_5]$ (b) $Ba_3[Co(CN)_5]_2$
(c) $Ba[Co(CN)_5]$ (d) $Ba_3[Co(CN)_5]$

28. A crystalline solid is made of two elements '*A*' and '*B*'. Atoms of '*A*' are present at corners and atoms of '*B*' at face centres. One atom of '*A*' is missing from a corner. The simplest formula of the solid will be

(a) A_7B_3 (b) A_8B_{21} (c) A_7B_{24} (d) AB_3

29. A sample of element has 12.08×10^{23} *bcc* unit cells. Total number of atoms in the given sample are

(a) 24.16×10^{23} (b) 12.08×10^{23}
(c) 36.24×10^{23} (d) 6.02×10^{23}

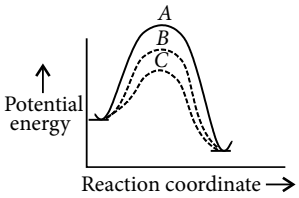
30. When aluminium oxide is electrolysed in the industrial process for the production of aluminium metal, aluminium is produced at one electrode and oxygen gas is produced at the other. For a given quantity of electricity, what is the ratio of moles of aluminium to moles of oxygen gas?

(a) 1 : 1 (b) 2 : 1 (c) 2 : 3 (d) 4 : 3

31. The ratio of anion radius to cation radius of a crystal is 10 : 9.3. Then, the coordination number of the cation in the crystal is

(a) 2 (b) 4 (c) 6 (d) 8

32. In homogeneous catalytic reaction, there are three alternative paths *A*, *B* and *C* (shown in the figure). Which one of the following indicates the relative ease with which the reaction can take place?



(a) $A > B > C$ (b) $C > B > A$
(c) $B > C > A$ (d) $A = B = C$

33. A galvanic cell is composed of two hydrogen electrodes, one of which is a standard one. In which of the following solutions should the other electrode be immersed to get maximum emf?
(a) 0.1 M HCl (b) 0.1 M H_2SO_4
(c) 0.1 M NH_4OH (d) 0.01 M HCOOH

34. In the following consecutive reactions,

$$A \xrightarrow{k = 2\times10^{-4}\ \text{min}^{-1}} B \xrightarrow{k = 6\times10^{-6}\ \text{min}^{-1}} C \xrightarrow{k = 3\times10^{-6}\ \text{min}^{-1}} D$$

which of the following steps is the rate determining step?
(a) $A \longrightarrow B$ (b) $B \longrightarrow C$
(c) $C \longrightarrow D$ (d) $A \longrightarrow D$

35. Which of the following pairs of unit cells have $a = b = c$ and $\alpha = \beta = \gamma$?
(a) Monoclinic and Orthorhombic
(b) Cubic and Rhombohedral
(c) Hexagonal and Tetragonal
(d) Triclinic and Rhombohedral

36. For the complex,

$$Ag^+ + 2NH_3 \rightleftharpoons [Ag(NH_3)_2]^+$$

$$\frac{dx}{dt} = 2 \times 10^7\ L^2\ mol^{-2}\ s^{-1}\ [Ag^+][NH_3]^2 - 1\times10^{-2}\ s^{-1}\ [Ag(NH_3)_2]^+$$

Hence, ratio of rate constants of the forward and backward reactions is
(a) $2 \times 10^7\ L^2\ mol^{-2}$ (b) $2 \times 10^9\ L^2\ mol^{-2}$
(c) $1 \times 10^{-2}\ L^2\ mol^{-2}$ (d) $0.5 \times 10^{-9}\ L^{-2}\ mol^2$

37. Bombardment of aluminium by α - particle leads to its artificial disintegration in two ways, (i) and (ii) as shown. Products *X*, *Y* and *Z* respectively are

$$^{27}_{13}Al \xrightarrow{\text{(ii)}} {}^{30}_{15}P + Y$$

$$\text{(i)} \downarrow \qquad\qquad \downarrow$$

$$^{30}_{14}Si + X \qquad\qquad {}^{30}_{14}Si + Z$$

(a) proton, neutron, positron
(b) neutron, positron, proton
(c) proton, positron, neutron
(d) positron, proton, neutron.

38. Colloid of which of the following can be prepared by electrical dispersion method as well as reduction method?
(a) Sulphur (b) Ferric hydroxide
(c) Arsenious sulphide
(d) Gold

39. Which of the following statements is not correct?
(a) Frenkel and Schottky defects are stoichiometric defects.
(b) AgBr crystal can have both Frenkel and Schottky defects.
(c) Ionic solids having high coordination number prefer Frenkel defect.
(d) Defects will always decrease stability.

40. The coagulation value in millimoles per litre of electrolytes used for the coagulation of As_2S_3 are as below :
I. NaCl = 52 II. KCl = 51
III. $BaCl_2$ = 0.69 IV. $MgSO_4$ = 0.22
The correct order of their flocculating power is
(a) I > II > III > IV (b) I > II > III = IV
(c) IV > III > II > I (d) IV = III > II > I

41. The example of cationic surfactant is
(a) $C_{18}H_{37}NH_2$ (b) $C_{16}H_{33}N(CH_3)_3Cl$
(c) $RC_6H_4SO_3Na$ (d) $C_{16}H_{33}C_6H_4NHCl$

42. Limiting equivalent conductance of $AlCl_3$, Na_2SO_4 and NaCl are *X*, *Y* and *Z* $ohm^{-1}\ cm^2\ eq^{-1}$. Limiting molar conductance of $Al_2(SO_4)_3$ is (in $ohm^{-1}\ cm^2\ mol^{-1}$)
(a) $X + Y - Z$ (b) $6(X + Y - Z)$
(c) $2X + 3Y - 6Z$ (d) $2X + 3Y - Z$

43. The maximum electrical work done by standard Daniell cell is

$$(E^\circ_{Zn^{2+}/Zn} = -0.76\ V,\ E^\circ_{Cu^{2+}/Cu} = +0.34\ V)$$

(a) 212 kJ (b) 424 kJ (c) 106 kJ (d) 318 kJ

44. First three nearest neighbours distance for body centred cubic lattice are respectively
(a) $\sqrt{2}a,\ a,\ \sqrt{3}a$ (b) $\frac{a}{\sqrt{2}}, a, \sqrt{3}a$
(c) $\frac{\sqrt{3}a}{2}, a, \sqrt{2}a$ (d) $\frac{\sqrt{3}a}{2}, a, \sqrt{3}a$

45. Which is not correct for corrosion of iron?
(a) A galvanic cell forms, in which Fe acts as anode.
(b) Electrons flow from anode to cathode through the metal while ions flow through the water droplet.
(c) Dissolved O_2 oxidises Fe^{2+} to Fe^{3+} before it is deposited as rust ($Fe_2O_3.xH_2O$).
(d) It is a non–spontaneous process.

SOLUTIONS

1. (d)

2. (d): Unit of A depends on unit of k.

3. (d) **4. (a)**

5. (a): Given : $r = k[A]\,[B]^2$

$r = 2.0 \times 10^{-6} \times (0.1)\,(0.2)^2 = 8.0 \times 10^{-9}$ mol L^{-1} s^{-1}

When $[A]$ is reduced to 0.06 M, then $[B]$ is reduced to 0.18 M because A and B reacts in a mole ratio of 2 : 1 then, $r = 2.0 \times 10^{-6} \times (0.06)\,(0.18)^2$

$r = 3.89 \times 10^{-9}$ mol L^{-1} s^{-1}

6. (d): Zn is anode and Cd is cathode.

$$\therefore \quad E_{cell} = 0.36 + \frac{0.059}{2}\log\frac{0.2}{0.004}$$

7. (c) **8. (c)**

9. (c): Net cell reaction :

$$Cd_{(s)} + 2Ag^{+}_{(aq)} \longrightarrow Cd^{2+}_{(aq)} + 2Ag_{(s)}$$

10. (b): Volume ratio of O_2, H_2 is 5.6 : 11.2

1 : 2 [for the same current]

$\therefore$ Cost to produce equal volume $= \frac{X}{2}$

11. (b): $\frac{r_+}{r_-} = \frac{96}{200} = 0.48$

12. (d)

13. (c): $\Delta G = \Delta H - T\Delta S$

For adsorption, ΔG = –ve, ΔH = –ve and ΔS = –ve, thus entropy of system decreases during adsorption.

14. (c) **15. (b)** **16. (c)**

17. (c) **18. (d)** **19. (c)**

20. (d): Increase in concentration of weak electrolyte decreases ionisation, thus decreases the conductivity. Increase in concentration of strong electrolyte increases the interionic attraction, thus decreases the conductivity.

21. (a): $MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O$; $E^\circ = 1.51$ V

$\Delta G_1^\circ = -5(1.51)F = -7.55F$

$MnO_2 + 4H^+ + 2e^- \longrightarrow Mn^{2+} + 2H_2O$; $E^\circ = 1.23$ V

$\Delta G_2^\circ = -2(1.23)F = -2.46F$

On subtracting

$MnO_4^- + 4H^+ + 3e^- \longrightarrow MnO_2 + 2H_2O$; $\Delta G_3^\circ = -5.09F$

$$E^\circ_{MnO_4^-|MnO_2} = \frac{\Delta G_3^\circ}{-nF} = \frac{-5.09F}{-3F} = 1.70\,V$$

22. (d): $\Lambda^\infty_{eq(HF)} = \Lambda^\infty_{eq(NaF)} + \Lambda^\infty_{eq(HCl)} - \Lambda^\infty_{eq(NaCl)}$

23. (c): $\overset{+8}{Mn_3O_4} \longrightarrow 3\overset{+18}{Mn}O_4^{2-} + 10e^-$

24. (c) **25. (d)** **26. (a)**

27. (b): $i = 1 + (n-1)\alpha$

$4 = 1 + (n-1)0.75 \Rightarrow n = 5$

28. (c): Number of atoms of 'A' $= 7 \times \frac{1}{8} = \frac{7}{8}$

Number of atoms of 'B' $= 6 \times \frac{1}{2} = 3$

Simplest ratio of A and B $= \frac{7}{8} : 3 = 7 : 24$

Simplest formula = A_7B_{24}

29. (a) **30. (d)**

31. (d): $\frac{r_+}{r_-} = 0.93$

$\therefore$ It will be body centred cubic solid and coordination number will be 8.

32. (b)

33. (c): For given concentration cell;

$$E_{cell} = \frac{RT}{F}\log\frac{[H^+]_{RHS}}{[H^+]_{LHS}}$$

For maximum emf $[H^+]_{LHS}$ should be minimum and that is for $NH_4OH_{(aq)}$.

34. (c): Slowest step is the rate determining step, therefore, $C \longrightarrow D$ will be the rate determining step. Its rate constant is lowest.

35. (b)

36. (b): $K = \frac{k_f}{k_b} = \frac{2\times10^7}{10^{-2}} = 2\times10^9\ L^2\ mol^{-2}$

37. (a): $^{27}_{13}Al + {}^4_2He \longrightarrow {}^{30}_{14}Si + X$, $\quad (X = {}^1_1H)$

$^{27}_{13}Al + {}^4_2He \longrightarrow {}^{30}_{15}P + Y$, $\quad (Y = {}^1_0n)$

$^{30}_{15}P \longrightarrow {}^{30}_{14}Si + Z$, $\quad (Z = {}^0_{+1}e)$

38. (d) **39. (c)**

40. (c): Coagulation value is inversely proportional to their flocculating power.

41. (b)

42. (b): $\Lambda^\circ_{eq(Al_2(SO_4)_3)} =$

$\Lambda^\circ_{eq(AlCl_3)} + \Lambda^\circ_{eq(Na_2SO_4)} - \Lambda^\circ_{eq(NaCl)}$

$= X + Y - Z$

Molar conductance = Equivalent conductance × valency

$\Lambda^\circ_{m(Al_2(SO_4)_3)} = 6(X + Y - Z)$

43. (a): $E^\circ_{cell} = 0.34 - (-0.76) = +1.1$ V

$\Delta G^\circ = -nFE^\circ_{cell} = -2 \times 96{,}500 \times 1.1$

$= -212.3$ kJ/mol $= -212$ kJ/mol

44. (c) **45. (d)**

EXAMINER'S MIND CLASS XI

The questions given in this column have been prepared strictly on the basis of NCERT Chemistry for Class XI.
This year JEE (Main & Advanced)/AIPMT/AIIMS/other PMTs have drawn their papers heavily from NCERT books.

ENVIRONMENTAL CHEMISTRY | HYDROCARBONS

SECTION - I

Only One Option Correct Type

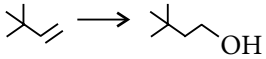
This section contains 20 multiple choice questions. Each question has four choices (a), (b), (c) and (d), out of which ONLY ONE is correct.

1. Which of the following statement is true?
(a) SO_3 is more harmful air pollutant than SO_2.
(b) SO_2 does not affect larynx (voice box).
(c) NO is more toxic to living tissues than NO_2.
(d) NO_x does not play any role in photochemical smog.

2. The reactivity of alkyl halides for Wurtz reaction is
(a) 1° > 2° > 3° (b) 3° > 2° > 1°
(c) 2° > 3° > 1° (d) 1° > 3° > 2°

3. Which of the following statements about photochemical smog is wrong?
(a) It does not involve smoke and fog.
(b) It has low concentration of oxidising agents.
(c) It can be controlled by controlling the release of NO_2, hydrocarbons, ozone etc.
(d) Plantation of some plants like pinus helps in controlling photochemical smog.

4. $B \xleftarrow[\text{catalyst}]{\text{Lindlar's}} R{-}C{\equiv}C{-}R \xrightarrow{Na/NH_3} A$
A and *B* are geometrical isomers of which type?
(a) *A* is *trans* and *B* is *cis* (b) *A* and *B* both are *cis*
(c) *A* and *B* both are *trans* (d) *A* is *cis* and *B* is *trans*.

5. 

The above hydration can be carried out by
(a) acid catalysed hydration
(b) oxymercuration-demercuration
(c) hydroboration-oxidation
(d) none of the above methods.

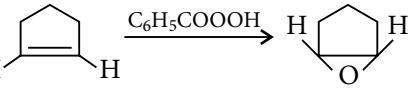
6. Carbon monoxide is naturally produced by oxidation of __X__, a gas present in swamp area while it can be produced by __Y__ of fuels containing carbon. Identify *X* and *Y*.
(a) *X* = CO_2, *Y* = complete combustion
(b) *X* = CH_4, *Y* = incomplete combustion
(c) *X* = C, *Y* = oxidation
(d) *X* = CH_4, *Y* = complete combustion

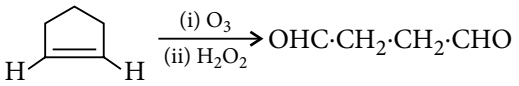
7. Ozonolysis of 2, 3-dimethyl-1-butene followed by reduction with zinc and water gives
(a) methanoic acid and 3-methyl-2-butanone
(b) methanol and 2-methyl-2-butanone
(c) methanal and 3-methyl-2-butanone
(d) methanoic acid and 2-methyl-2-butanone.

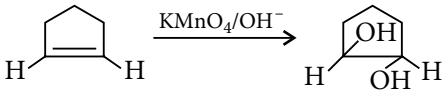
8. Which of the following is a sink for CO?
(a) Haemoglobin
(b) Microorganisms present in the soil
(c) Oceans (d) Plants

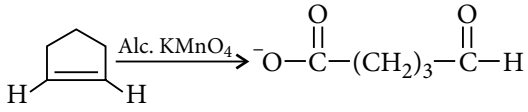
9. Complete the following reactions :
$CH_3COCH_3 \xrightarrow{NaNH_2} A \xrightarrow{C_2H_2} B \xrightarrow{H^+} C \xrightarrow[Pd]{H_2(1\ equiv)} D \xrightarrow[673\ K]{Al_2O_3,\ \Delta} E$
Compound *E* is
(a) $CH_3{-}CH{=}CH_2$ (b) $CH_3{-}\underset{\displaystyle CH_3}{\underset{|}{CH}}{-}CH{=}CH_2$
(c) $CH_2{=}\underset{\displaystyle CH_3}{\underset{|}{C}}{-}CH{=}CH_2$
(d) $CH_2{=}CH{-}CH{=}CH_2$

10. Which of the following causes damage to the buildings containing calcium carbonate and is responsible for cough and choking in human beings?
(a) Sulphur (b) Carbon
(c) Nitrogen dioxide (d) Sulphur dioxide

11. Which of the following is correct?
(a) 

(b) 

(c) 

(d) 

12. Which of the following practices involve green chemistry?

(I) Substitute CFCs by environmental friendly HFCs and other compounds.

(II) Replace halogenated solvent by liquid CO_2 for dry cleaning.

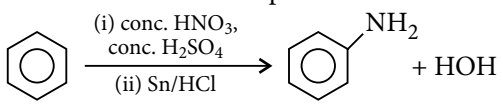
(III) Use of H_2O_2 for bleaching instead of Cl_2.

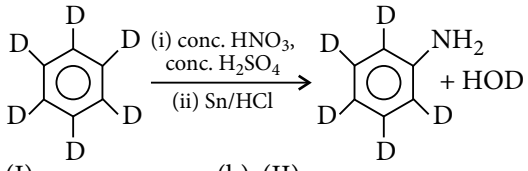
(IV) Making disposable eating utensils and storage jars of plastics.

(a) (I) and (II) (b) (II) and (IV)

(c) (III) and (IV) (d) (I), (II) and (III)

13. Which of the two reactions proceed faster?

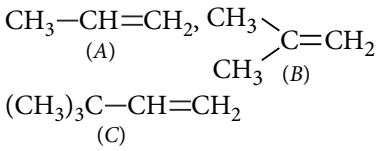
(I) 

(II) 

(a) (I) (b) (II)

(c) (I) = (II) (d) Cannot be predicted

14. The reactivity of the given alkenes towards hydrogen is



(a) $A > B > C$ (b) $A > C > B$

(c) $C > A > B$ (d) $C > B > A$

15. Which of the following statements is false?

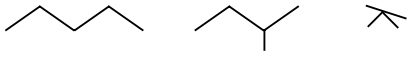
(a) The main reason for river water pollution is industrial and domestic sewage discharge.

(b) Surface water contains a lot of organic matter, mineral nutrients and radioactive materials.

(c) Oil spill in sea water causes heavy damage to fishery.

(d) Oil slick in sea water increases D.O. value.

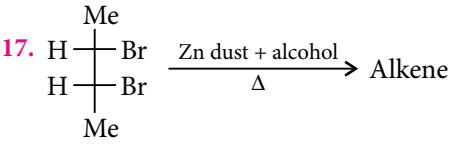
16. Which of the following has maximum boiling point and melting point respectively?



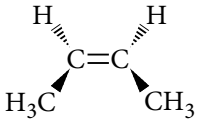
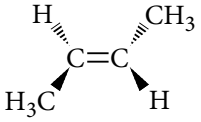
I II III

(a) I in both cases (b) I, II

(c) I, III (d) II, I

17. 

The alkene is

(a)  (b) 

(c) Me—C≡C—Me (d) Both (a) and (b)

18. Kharasch effect operates in which of the following?

(a) $CH_3CH_2CH{=}CH_2 + HCl$

(b) $CH_3CH_2{-}CH{=}CH_2 + HBr$

(c) $CH_3CH{=}CH{-}CH_3 + HBr$

(d) $CH_3CH_2CH{=}CH_2 + HI$

19. A cylinder of compressed gas that bears no label is supposed to contain either ethylene or propylene. Combustion of the sample shows that 12 cm^3 of the gas required 54 cm^3 of oxygen for complete combustion. This indicates that the gas is

(a) only ethylene (b) only propylene

(c) 1 : 1 mixture of the two gases

(d) some unknown mixture of the two gases.

20. Increasing skin cancer and high mutation rates are due to

(a) acid rain (b) ozone depletion

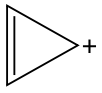
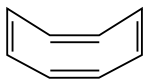
(c) CO pollution (d) CO_2 pollution.

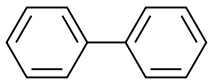
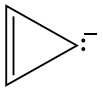
SECTION - II

One or More Options Correct Type

This section contains 5 multiple choice questions. Each question has four choices (a), (b), (c) and (d), out of which ONE or MORE are correct.

21. Which of the following is/are aromatic in nature?

(a)  (b) 

(c)  (d) 

22. Peeling of ozone umbrella is due to

(a) PAN (b) freons (c) CO_2 (d) NO

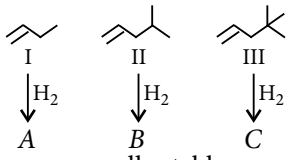
23. Toluene can be prepared by

(a) heating sodium salt of *p*-toluic acid with soda lime

(b) distillation of *m*-cresol with Zn dust
(c) treating phenyl magnesium bromide with methanol
(d) reduction of benzyl alcohol with HI and red P.

24. Man made sources of air pollution are
(a) population increase (b) deforestation
(c) war (d) pollen grains.

25. Which of the following statements is/are correct regarding stability of the parent alkenes and the product alkanes?



(a) All alkenes are equally stable.
(b) Alkene III is more stable than I and II.
(c) All alkanes are equally stable.
(d) Alkane *C* is more stable than *A* and *B*.

SECTION - III

Paragraph Type

This section contains 2 paragraphs each describing theory, experiment, data, etc. Six questions relate to two paragraphs with three questions on each paragraph. Each question of a paragraph has only one correct answer among the four choices (a), (b), (c) and (d).

Paragraph for Questions 26 to 28

In 1980s atmospheric scientists working in Antarctica reported about depletion of ozone layer commonly known as ozone hole over the South Pole. In summer season, nitrogen dioxide and methane react with chlorine monoxide and chlorine atoms forming chlorine sinks, preventing much ozone depletion, whereas in winter, special type of clouds are formed over Antarctica.

26. Which of the following chemicals present in chlorofluorocarbon is harmful to ozone?
(a) Fluorine (b) Chlorine
(c) Nitrogen dioxide (d) Sulphur dioxide

27. Ozone hole refers to
(a) hole in the ozone layer
(b) reduction in thickness of the ozone layer in troposphere
(c) reduction in thickness of the ozone layer in stratosphere
(d) increase in the concentration of ozone.

28. Ozone layer of stratosphere requires protection from indiscriminate use of
(a) pesticides (b) atomic explosions
(c) aerosols and high flying jets
(d) balloons.

Paragraph for Questions 29 to 31

Hydrogen atoms in ethyne are attached to the *sp* hybridised carbon atoms whereas they are attached to sp^2 hybridised carbon atoms in ethene and sp^3 hybridised carbons in ethane. Due to the maximum percentage of *s* character (50%), the *sp*-hybridised orbitals of carbon atoms in ethyne molecules have highest electronegativity; hence, these attract the shared electron pair of the C—H bond of ethyne, hybridised orbitals of carbon in ethene and the sp^3 hybridised orbital of carbon in ethane. Thus in ethyne, hydrogen atoms can be liberated as protons more easily as compared to ethene and ethane.

29. Which of the following compounds reacts with sodium to liberate hydrogen gas?
(a) Ethane (b) Propylene
(c) Acetylene (d) Benzene

30. The order of relative acidic strengths of water, ammonia and acetylene is
(a) water > ammonia > acetylene
(b) ammonia > water > acetylene
(c) water > acetylene > ammonia
(d) acetylene > water > ammonia.

31. Which of the following reacts with an aqueous solution of $[Ag(NH_3)_2]^+OH^-$?
(a) $CH_3—C\equiv C—CH_3$ (b) $CH_3—CH=CH_2$
(c) $CH_3—C\equiv CH$ (d) $CH_3—CH=CH—CH_3$

SECTION - IV

Matching List Type

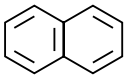
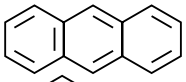
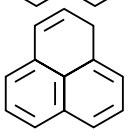
This section contains 3 multiple choice questions. Each question has matching lists. The codes for the lists have choices (a), (b), (c) and (d), out of which ONLY ONE is correct.

32. Match the types of pollutants given in List I with their examples given in List II and select the correct answer using the code given below the lists :

	List I		**List II**
P.	Biodegradable pollutants	1.	DDT
Q.	Non-biodegradable pollutants	2.	SO_2
R.	Primary pollutants	3.	PAN
S.	Secondary pollutants	4.	Sewage

	P	**Q**	**R**	**S**
(a)	1	2	3	4
(b)	4	2	1	3
(c)	4	1	2	3
(d)	4	1	3	2

33. Match the List I with List II and select the correct answer using the code given below the lists :

List I		List II $\left(\frac{\sigma \text{ bond}}{\pi \text{ bond}}\right)$
P.		1. $\frac{19}{5} = 3.8$
Q.		2. $\frac{12}{3} = 4$
R.		3. $\frac{25}{6} = 4.166$
S.		4. $\frac{26}{7} = 3.71$

	P	Q	R	S
(a)	1	2	3	4
(b)	4	2	1	3
(c)	2	1	4	3
(d)	2	4	1	3

34. Match the reactions given in List I with their products given in List II and select the correct answer using the code given below the lists :

List I		List II
P.	Decarboxylation of sodium acetate	1. Ethyne
Q.	Wurtz-reaction	2. 2-Methylpropene
R.	Kolbe's electrolytic reaction	3. *n*-Butane
S.	Dehydrohalogenation	4. Methane

	P	Q	R	S
(a)	4	3	2	1
(b)	1	4	3	2
(c)	4	3	1	2
(d)	1	3	4	2

SECTION - V

Assertion-Reason Type

In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as :

(a) If both assertion and reason are true and reason is the correct explanation of assertion.
(b) If both assertion and reason are true but reason is not the correct explanation of assertion.
(c) If assertion is true but reason is false.
(d) If both assertion and reason are false.

35. **Assertion :** The regioselectivity of electrophilic addition is governed by the ability of an aromatic ring to stabilise an adjacent carbocation.
Reason : Aromatic ring is stabilised by resonance due to delocalisation of π electrons.

36. **Assertion :** Chlorine sinks are formed during summer, hence, preventing ozone depletion.
Reason : In summer season, nitrogen dioxide and methane react with chlorine monoxide and chlorine radicals.

37. **Assertion :** In cracking of alkanes C—C bond is broken but not C—H bonds.
Reason : Bond energy of C—C bond is less than C—H bond.

38. **Assertion :** The temperature in the stratosphere increases with altitude.
Reason : Ozone present absorbs ultraviolet radiation which is converted into heat.

39. **Assertion :** Classical smog is oxidising smog whereas photochemical smog is reducing smog.
Reason : Classical smog occurs in warm, dry and sunny climate whereas photochemical smog occurs in cool humid climate.

40. **Assertion :** Addition of H_2O to acetylene occurs in presence of dil. H_2SO_4 and $HgSO_4$ to give acetaldehyde.
Reason : It is an example of electrophilic addition reaction.

SECTION - VI

Integer Value Correct Type

This section contains 10 questions. The answer to each question is a single digit integer, ranging from 0 to 9 (both inclusive).

41. How many isomeric alkenes are possible in the dehydration of 2,3-dimethylbutan-1-ol?

42. From the list of components given, the number of components that causes irritation to eyes is Ozone, acrolein, PAN, nitric oxide

43. From the given list of compounds, the number of compounds which exhibit geometrical isomerism is But-1-ene, But-2-ene, $CHCl{=}CHCl$, $CCl_2{=}CHCl$, $CH_2{=}CCl_2$

44. The maximum permissible value of BOD of clean water is

45. Sodium salt of a dicarboxylic acid contains *n* carbon atoms. The compound formed by electrolysis of this salt contains $(n-x)$ carbon atoms. The value of x is

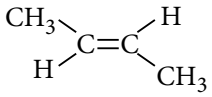
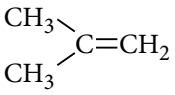
46. The number of primary pollutants present in the given list is
SO_2, NO_2, SO_3, O_3, HNO_3, NO, CO

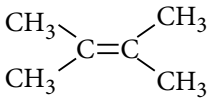
47. The total number of equatorial H-atoms in cyclohexane is

48. The number of greenhouse gases in the given list is CO_2, CCl_4, CH_4, SO_3, O_3, SO_2

49. The number of compounds which have higher enthalpy of hydrogenation than *cis*-2-butene is

(i) $CH_2=CH_2$ (ii) $CH_3-CH=CH_2$

(iii)  (iv) 

(v) 

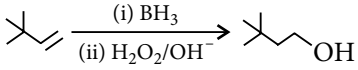
50. *Cis*-2-butene reacts with alkaline $KMnO_4$. Number of optical isomers formed is

SOLUTIONS

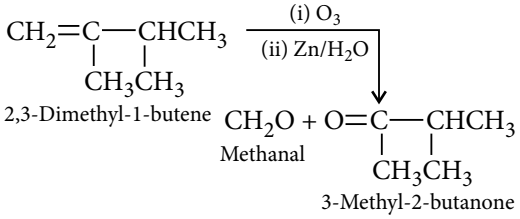
1. (a) : SO_3 is more harmful pollutant than SO_2.

2. (a) **3. (b)** **4. (a)**

5. (c) : Hydroboration-oxidation of an alkene gives *anti*-Markovnikov's product.



6. (b)

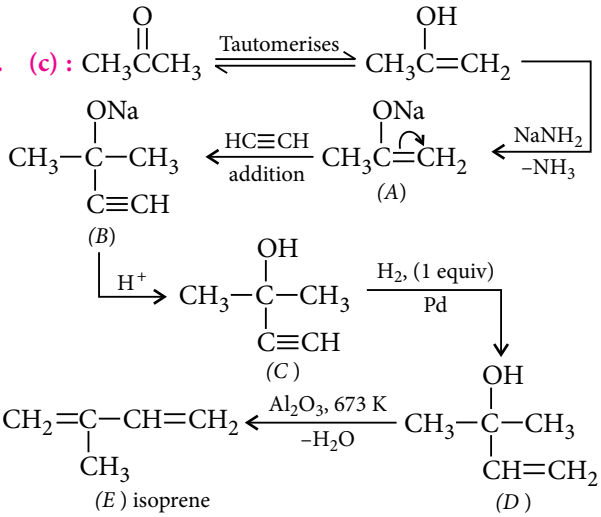
7. (c) : 

2,3-Dimethyl-1-butene

Methanal

3-Methyl-2-butanone

8. (b) : Microorganisms convert CO into CO_2.

9. (c) : 

(*B*) (*C*) (*A*)

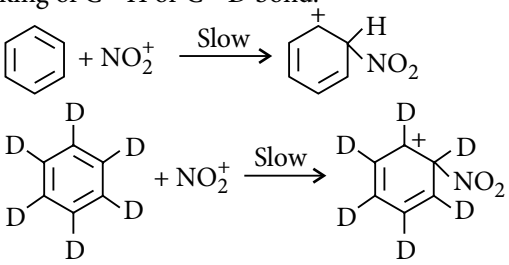
(*E*) isoprene (*D*)

10. (d) : SO_2 in air and moisture gives H_2SO_4 which reacts with marble (calcium carbonate) and causes damage to buildings. Also it causes cough and choking in human beings.

11. (a) : Peracids give epoxides with alkenes.

12. (d)

13. (c) : Electrophilic substitution in benzene is a two step reaction in which slow step (first step) is common in both reactions as it does not involve the breaking of C—H or C—D bond.



Had the rate determining step (slow step) involved the cleavage of C—H or C—D bond, then nitration of benzene would have been faster than that of hexadeuterated benzene.

14. (c) : The reactivity of alkenes towards hydrogen depends on the hyperconjugation effect in the alkene. More the hyperconjugation effect, more is the stability of alkene and lesser is the reactivity. The hyperconjugation effect in the given alkene is $B > A > C$. Thus, stability is $B > A > C$ and hence reactivity with H_2 is $C > A > B$.

15. (d) **16. (a)**

17. (b) : The dehalogenation reactions are *trans*-elimination reactions.

18. (b)

19. (b) : (i) $\underset{12\ cm^3}{CH_2=CH_2} + \underset{36\ cm^3}{3O_2} \longrightarrow 2CO_2 + 2H_2O$

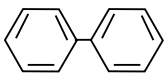
(ii) $\underset{12\ cm^3}{CH_3CH=CH_2} + \underset{12\times\frac{9}{2}\ =\ 54\ cm^3}{\frac{9}{2}O_2} \longrightarrow 3CO_2 + 3H_2O$

Thus, 12 cm^3 of propylene require 54 cm^3 of O_2 and hence cylinder contains only propylene.

20. (b) : Ozone depletion let the UV rays reach earth which cause increased skin cancer and high mutation rates.

21. (a, c) : In both, rings are planar and follow $(4n + 2)\pi$-electrons rule.

(a)  2π-electrons which are delocalised.

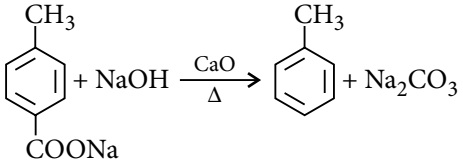
(c)  Both rings have 6π-electrons, which are delocalised and conjugated.

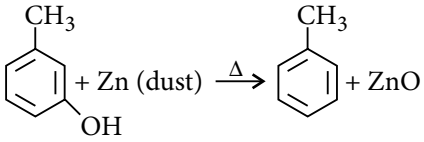
Cyclooctatetraene is non-planar and has 8 π-electrons. It is not aromatic.

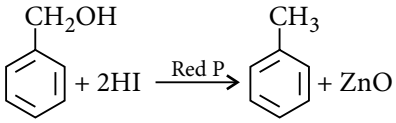
Cyclopropenyl anion is planar but has 4 π-electrons hence, it is not aromatic.

22. (b, d)

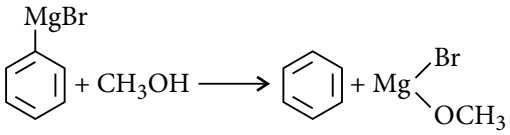
23. (a, b, d) :

(a) 

(b) 

(d) 

(c) It is not possible because it gives benzene and not toluene.



24. (a, b, c)

25. (a, d) : The three alkenes have similar heat of hydrogenation because the alkanes formed have similar energies. The branched alkane is more stable, greater the branching in an alkane, more is its stability.

26. (b) : $CF_2Cl_2 \xrightarrow{h\nu} \dot{C}F_2Cl + Cl^{\bullet}$;

$Cl^{\bullet} + O_3 \longrightarrow Cl\dot{O} + O_2$

27. (c)

28. (c) : Aerosols use CFCs and high flying jets release NO which are responsible for depletion of ozone layer.

29. (c) : Only acetylene has acidic hydrogen and hence reacts with Na to evolve H_2 gas.

$2HC{\equiv}CH + 2Na \longrightarrow 2HC{\equiv}CNa + H_2$

30. (c)

31. (c) : Only terminal alkynes, *i.e.*, $CH_3C{\equiv}CH$ react with Tollens' reagent *i.e.*, $[Ag(NH_3)_2]^+OH^-$.

32. (c) **33. (c)** **34. (c)** **35. (b)**

36. (a) : During summer, nitrogen dioxide and methane react with chlorine monoxide and chlorine radicals, forming chlorine sinks, preventing much ozone depletion.

$Cl\dot{O} + NO_2 \longrightarrow ClONO_2$

$\dot{C}l + CH_4 \longrightarrow \dot{C}H_3 + HCl$

$ClONO_2 + H_2O \longrightarrow HOCl + HNO_3$

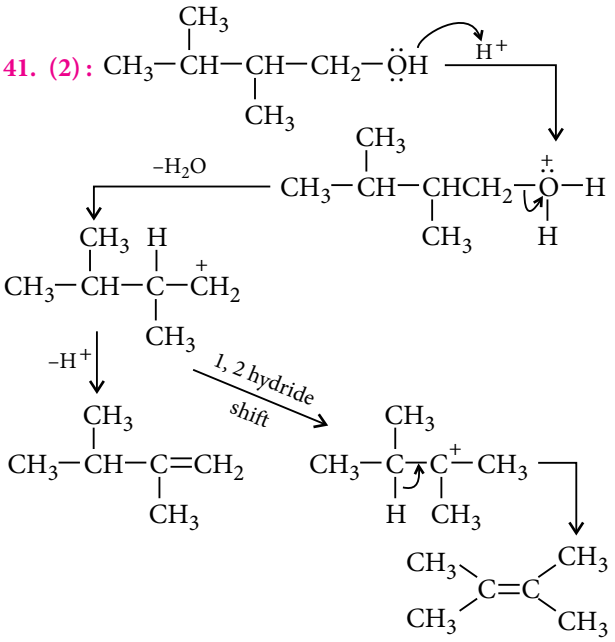
$ClONO_2 + HCl \longrightarrow Cl_2 + HNO_3$

37. (a) **38. (a)**

39. (d) : Classical smog occurs in cool humid climate. Chemically it is a reducing mixture and so it is also called as reducing smog.

Photochemical smog occurs in warm, dry and sunny climate. It has high concentration of oxidising agents and is therefore, called as oxidising smog.

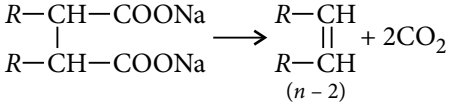
40. (a)

41. (2) : 

42. (2) : Ozone and PAN act as powerful eye irritants.

43. (2)

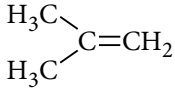
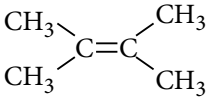
44. (5) : BOD of clean water is less than 5 ppm.

45. (2) : 

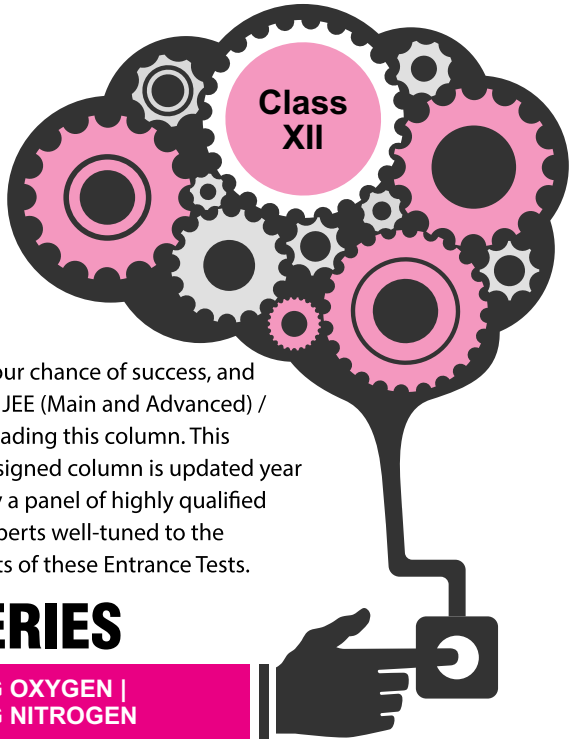
46. (4) : SO_2, NO_2, NO and CO are primary pollutants, whereas SO_3, O_3 and HNO_3 are secondary pollutants.

47. (6)

48. (3) : CO_2, CH_4 and O_3 are greenhouse gases.

49. (2) : The $\Delta H_{hydrogenation}$ values of $CH_2{=}CH_2$ and $CH_3{-}CH{=}CH_2$ are higher than that of *cis*-but-2-ene and that of others is lesser or equal *e.g.*, *cis* and *trans* but-2-ene have almost same while  and  is lesser as they are more stable than *cis*-but-2-ene.

50. (0)



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ACCELERATED LEARNING SERIES

Unit 7 ORGANIC COMPOUNDS CONTAINING OXYGEN | ORGANIC COMPOUNDS CONTAINING NITROGEN

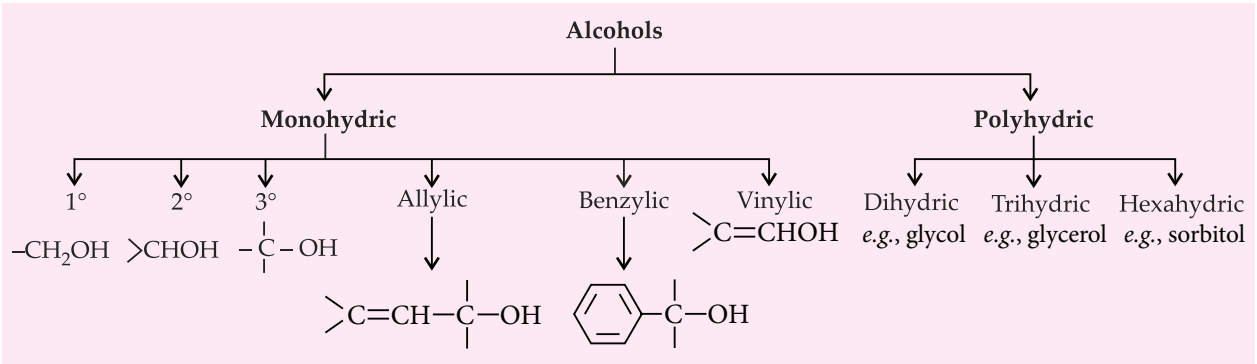
ORGANIC COMPOUNDS CONTAINING OXYGEN

- Alcohols, Phenols and Ethers
- Aldehydes and Ketones
- Carboxylic Acids

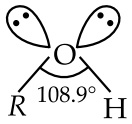
TIPS TO REMEMBER

Alcohols

- Alcohols are hydroxy derivatives of aliphatic or alicyclic hydrocarbons or side chain hydroxy derivatives of aromatic hydrocarbons.
- General formula is $C_nH_{2n+1}OH$.
- In IUPAC system, alcohols are named as alkanols *i.e.*, by replacing *–e* from alkane by *–ol*.
- **Classification :** Alcohols may be classified as monohydric or polyhydric depending on the number of hydroxyl groups present in their molecules. Monohydric alcohols are further classified into 1°, 2° or 3° alcohols based on the type of carbon atom to which the hydroxyl group is attached.



- **Structure :** In alcohols, $R-OH$, the O atom of hydroxyl group is attached to C atom by a sigma (σ) bond formed by the overlap of sp^3 hybridised orbital of C atom with sp^3 hybridised orbital of O atom.
  - O atom of the hydroxyl group has two bond pairs and two lone pairs of electrons. The C–O–H bond is not linear and the bond angle is 108.9°, slightly less than tetrahedral angle (109°28′) due to the repulsion between two lone pairs of electrons of O atom.



❑ Preparation :

Methods of Preparation

1. Hydrolysis of alkyl halides

$RX + KOH_{(aq.)} \xrightarrow{\Delta} ROH + KX$

2. Hydration of alkenes

$RCH=CH_2 + H_2SO_4 \longrightarrow R-CH(CH_3)-HSO_4$

$R-CH(CH_3)-OH \xleftarrow[\text{boil}]{H_2O} R-CH(CH_3)-HSO_4$

3. Hydroboration-oxidation

$3CH_3CH=CH_2 \xrightarrow{BH_3/THF} (CH_3CH_2CH_2)_3B$

$H_3BO_3 + 3CH_3CH_2CH_2OH \xleftarrow[OH^-]{3H_2O_2} (CH_3CH_2CH_2)_3B$

4. Hydrolysis of esters

$RCOOR' + H_2O \xrightarrow[OH^-]{H^+/} RCOOH + R'OH$

Alcohols $C_nH_{2n+1}OH$

5. Hydrolysis of ethers

$ROR' + H_2O \xrightarrow[\Delta]{\text{dil. } H_2SO_4} ROH + R'OH$

6. Bouveault-Blanc reduction

$RCHO + 2[H] \xrightarrow[\text{or Pd catalyst}]{\text{Ni or Pt}} RCH_2OH$

7. Reduction with LAH

$RCOOH + 4[H] \xrightarrow{LiAlH_4} RCH_2OH + H_2O$

8. Addition of Grignard's reagent

$>C=O + RMgX \xrightarrow{\text{dry ether}} >C(OMgX)(R)$

$Mg(OH)X + >C(OH)R \xleftarrow[H^+]{H_2O}$

❑ Physical properties :

- The lower members are colourless mobile liquids. Higher members are wax like solids.
- The lower members have a characteristic smell (alcoholic) and a burning taste while solid members are almost colourless and tasteless.
- The first three members are highly miscible with water. However, the solubility in water decreases with rise of molecular mass. The solubility in water is due to hydrogen bonding as – OH groups present both in alcohol and water are highly polarised.

$H^{\delta+}-O^{\delta-}(H)\cdots H^{\delta+}-O^{\delta-}(R)\cdots H^{\delta+}-O^{\delta-}(H)\cdots H^{\delta+}-O^{\delta-}(R)\cdots H^{\delta+}-O^{\delta-}(H)$

- Among the isomeric alcohols, the solubility increases with increase in branching. This can be attributed to decrease in relative volume of hydrophobic portion.
- Boiling points of alcohols increase gradually with increase of carbon chain.
- Among isomeric alcohols, the boiling points are in the following order :

  Primary > Secondary > Tertiary

  i.e., the boiling point decreases with branching.
- The boiling points of alcohols are higher as compared to the corresponding alkanes, ethers and alkyl halides. The reason for the higher boiling points than expected is due to intermolecular association of a large number of molecules due to hydrogen bonding as – OH group is highly polarised.

❑ Chemical properties :

- *Reactions involving cleavage of* O—H *bond :*

R—O—H

Metals
- $Na \text{ or } K \rightarrow RO-Na + H_2$
- $Mg \text{ or } Ca \rightarrow (RO)_2Ca + H_2$
- $Al \rightarrow (RO)_3Al + H_2$

Metal hydrides
- $MH \rightarrow RO-M + H_2$

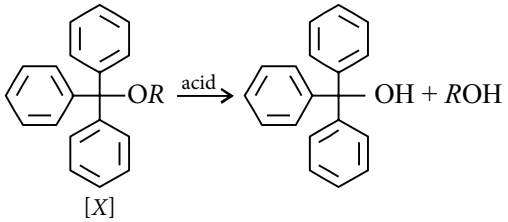
Esterification
- $R'COOH/H^+ \rightarrow RO-COR' + H_2O$
- $R'COCl/Pyridine \rightarrow RO-COR' + HCl$
- $(R'CO)_2O/H^+ \rightarrow RO-COR' + R'COOH$

- $R'MgX \rightarrow RO-MgX + R'H$
- R'_2SO_4, 413 K $\rightarrow RO-R' + R'HSO_4$

Inorganic acids
- Conc. H_2SO_4, 383 K $\rightarrow RO-SO_2OH + H_2O$
- Conc. $HNO_3 \rightarrow RO-NO_2 + H_2O$

SELF CHECK

1. The acidic hydrolysis of ether (*X*) shown below is fastest when



[*X*]

(a) one phenyl group is replaced by a methyl group

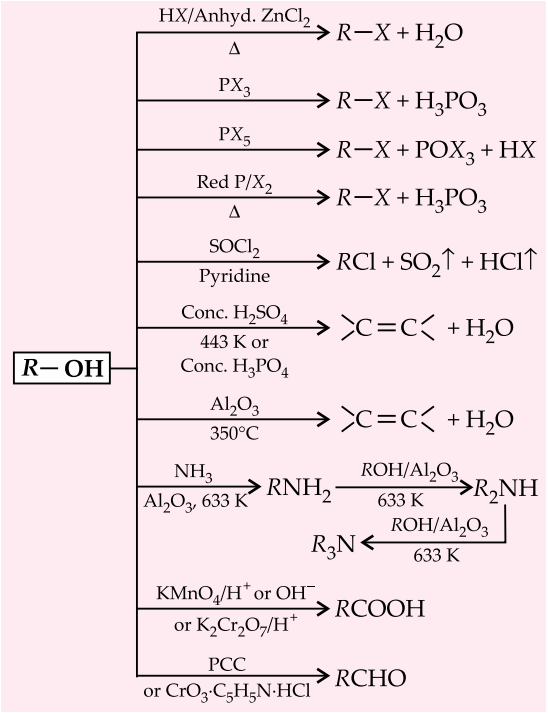
(b) one phenyl group is replaced by a *para*-methoxyphenyl group

(c) two phenyl groups are replaced by two *para*-methoxyphenyl groups

(d) no structural change is made to *X*.

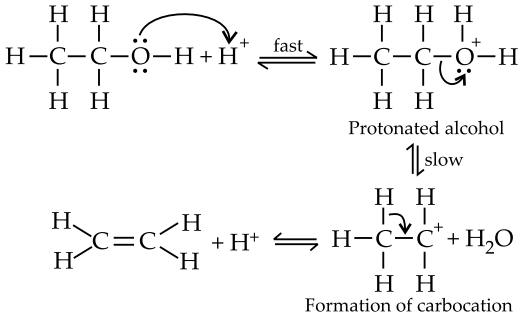
(JEE Advanced 2014)

- *Reactions involving cleavage of* C—O *bond :*



Mechanism of dehydration of alcohols :

$$C_2H_5OH \xrightarrow[443\ K]{Conc.\ H_2SO_4} CH_2=CH_2 + H_2O$$



Distinction between 1°, 2° and 3° alcohols :

- *Dichromate test (Oxidation test) :*

Primary	Secondary	Tertiary
$R-CH_2OH$ [O], $Na_2Cr_2O_7 + H_2SO_4$ $R-\underset{\underset{O}{\|}}{C}-H$ Aldehyde [O], $Na_2Cr_2O_7 + H_2SO_4$ $R-\underset{\underset{O}{\|}}{C}-OH$ Acid (orange solution becomes green)	$R'-\underset{H}{\overset{R}{C}}-OH$ [O], $Na_2Cr_2O_7 + H_2SO_4$ $R'-\overset{R}{C}=O$ Ketone (orange solution becomes green)	$R'-\overset{R}{\underset{R''}{C}}-OH$ [O], $Na_2Cr_2O_7 + H_2SO_4$ No reaction under normal conditions (solution remains orange)

- *Victor Meyer's test :*

Primary	Secondary	Tertiary
RCH_2OH P/I_2 or HI RCH_2I $AgNO_2$ RCH_2NO_2 HONO $R-\underset{\underset{NOH}{\|}}{C}-NO_2$ Nitrolic acid NaOH Blood red colour	$\begin{matrix}R\\R\end{matrix}\!\!>\!CHOH$ P/I_2 or HI $\begin{matrix}R\\R\end{matrix}\!\!>\!CHI$ $AgNO_2$ $\begin{matrix}R\\R\end{matrix}\!\!>\!CHNO_2$ HONO $\begin{matrix}R\\R\end{matrix}\!\!>\!\underset{\underset{NO}{\|}}{C}-NO_2$ Pseudo nitrol NaOH Blue colour	$\begin{matrix}R\\R\\R\end{matrix}\!\!>\!C-OH$ P/I_2 or HI $\begin{matrix}R\\R\\R\end{matrix}\!\!>\!C-I$ $AgNO_2$ $\begin{matrix}R\\R\\R\end{matrix}\!\!>\!C-NO_2$ HONO No reaction NaOH Colourless

- *Lucas test :* Lucas reagent is a solution of conc. HCl with anhyd. $ZnCl_2$.
With Lucas reagent,
Primary alcohols – No cloudiness
Secondary alcohols – Cloudiness in 5 minutes
Tertiary alcohols – Cloudiness immediately

- *Catalytic dehydrogenation :*

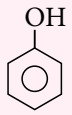
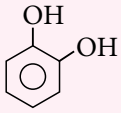
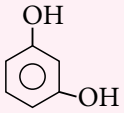
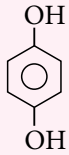
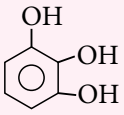
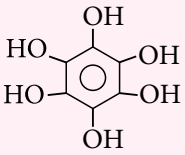
$$\underset{1^\circ\ Alcohol}{RCH_2OH} \xrightarrow[300^\circ C]{Cu} \underset{Aldehyde}{RCHO} + H_2 \quad [Dehydrogenation]$$

$$\underset{2^\circ\ Alcohol}{\begin{matrix}R\\R\end{matrix}\!\!>\!CHOH} \xrightarrow[300^\circ C]{Cu} \underset{Ketone}{\begin{matrix}R\\R\end{matrix}\!\!>\!C=O} + H_2 \quad [Dehydrogenation]$$

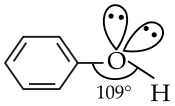
$$\underset{3^\circ\ Alcohol}{\begin{matrix}CH_3\\CH_3\\CH_3\end{matrix}\!\!>\!C-OH} \xrightarrow[300^\circ C]{Cu} \underset{Alkene}{\begin{matrix}CH_3\\CH_3\end{matrix}\!\!>\!C=CH_2} + H_2O \quad [Dehydration]$$

Phenols

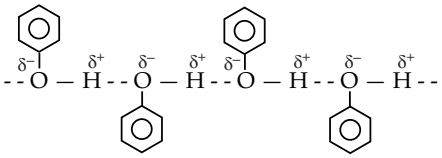
- Phenols are aromatic hydroxy compounds in which the —OH group is directly attached to the benzene ring.
- Phenol, also called *carbolic acid* was first isolated in the early 19th century from coal tar.
- **Classification :**

Monohydric	Dihydric		
 Phenol	 Catechol	 Rasorcinol	 Hydroquinone
Trihydric	**Polyhydric**		
 Pyrogallol	 Hexaphenol		

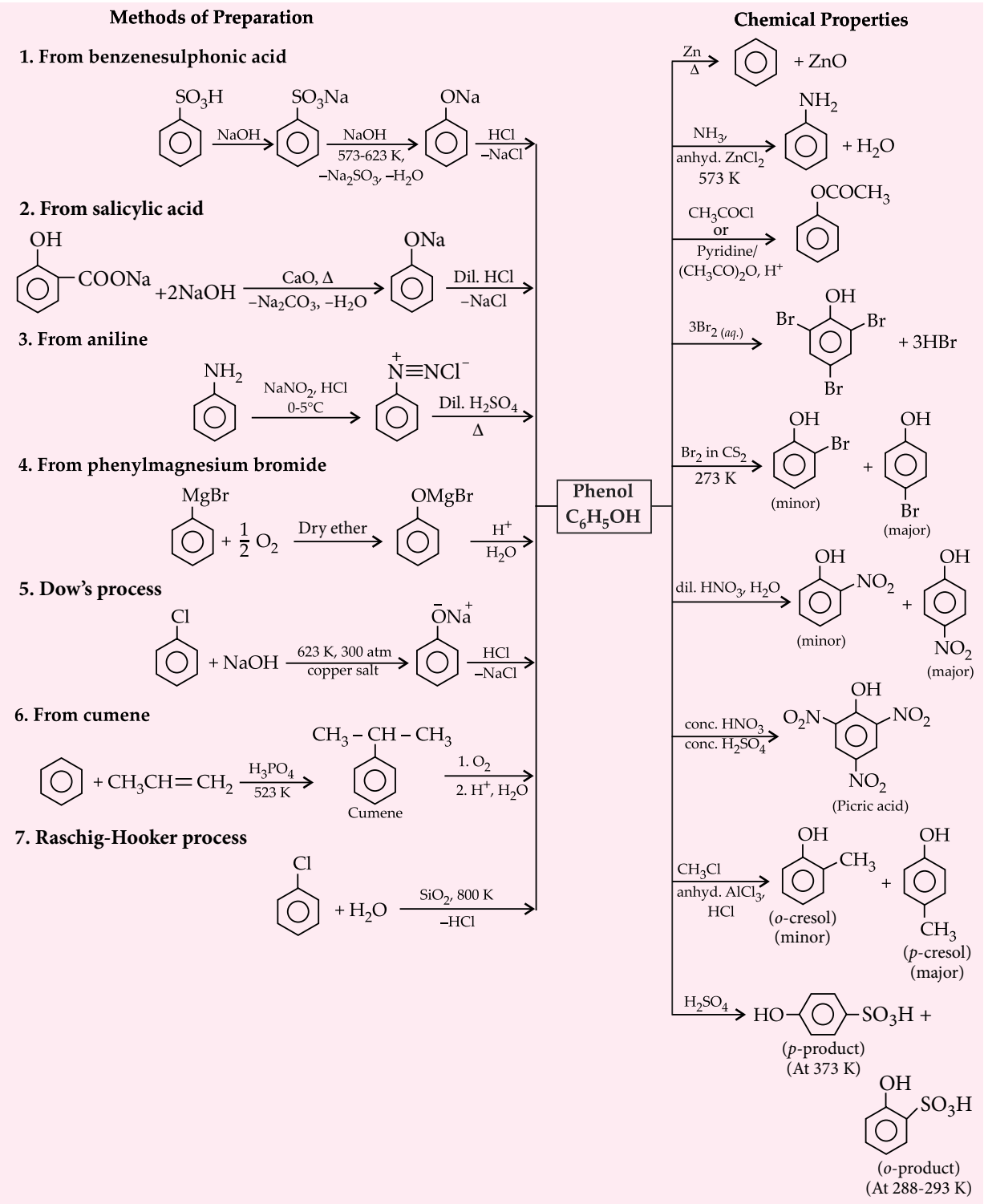
- **Nomenclature :** The simplest hydroxy derivative of benzene is phenol. It is the common name and also an accepted IUPAC name.
  - As structure of phenol involves a benzene ring, in its substituted compounds the terms *ortho* (1,2-disubstituted), *meta* (1,3-disubstituted) and *para* (1, 4-disubstituted) are used in the common names.
- **Structure :** In phenols, the —OH group is attached to sp^2 hybridised C atom of an aromatic ring.
  - The C—O bond length in phenol is slightly less than the C—O bond length in alcohol due to partial double bond character of C—O bond and sp^2 hybridised state of C atom to which O atom is attached.



- **Physical properties :**
  - *State and smell :* Phenols are colourless, crystalline solids or liquids. They have characteristic phenolic odours.
  - *Solubility :* Unlike alcohols, phenols are sparingly soluble in water. The non-polar aryl group is very large in size and it almost completely masks the polar character of the —OH group. However, phenols are soluble in alcohols, ethers and also in NaOH.
  - *Boiling points :* The boiling points of phenols are higher than those of the aromatic hydrocarbons of comparable molecular masses. For example, boiling point of phenol (molecular mass = 94) is 455 K while that of toluene (molecular mass = 92) is 384 K. The higher boiling point is due to the presence of intermolecular hydrogen bonding in phenols. Therefore, they exist as associated molecules.



❑ Preparation and properties :



❑ Acidic nature :

- Phenol is a stronger acid than alcohols because the phenoxide ion formed by loss of H^+ ion is stabilised due to resonance whereas alkoxides ions are not.
- Electron withdrawing groups increase the acidity while electron donating groups decrease the acidity of phenols.
- Phenol itself is, however, a weaker acid than carbonic acid (H_2CO_3) and hence, does not

decompose $NaHCO_3$ to evolve CO_2. Instead phenols are precipitated from the aqueous solutions of the phenoxides by bubbling CO_2 through them.

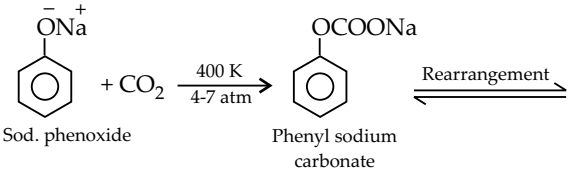
$$C_6H_5ONa + CO_2 + H_2O \longrightarrow C_6H_5OH + NaHCO_3$$

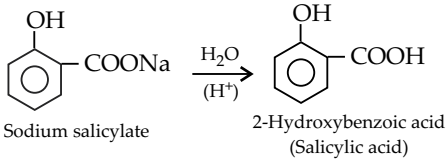
- Phenol dissolves in strong alkalies and evolve H_2 when treated with alkali metals.

$$C_6H_5OH + NaOH \longrightarrow C_6H_5ONa + H_2O$$
$$2C_6H_5OH + 2Na \longrightarrow 2C_6H_5ONa + H_2$$

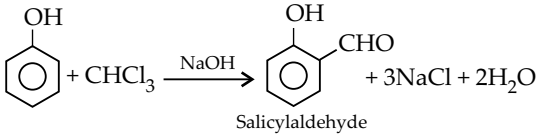
Some special reactions :

- *Kolbe's reaction :*





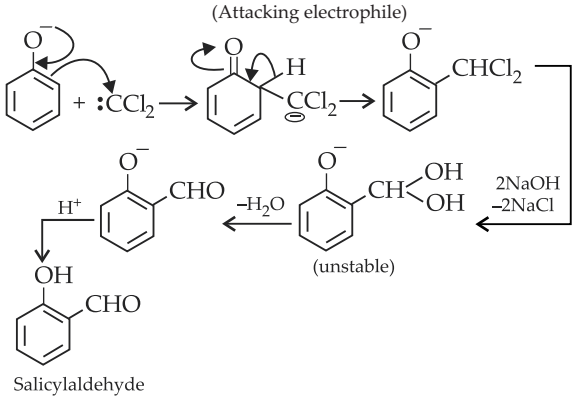
- *Reimer-Tiemann reaction :* Phenols on reaction with chloroform in presence of aqueous sodium or potassium hydroxide solution followed by acidification yield 2-hydroxybenzaldehyde *i.e.*, salicylaldehyde.



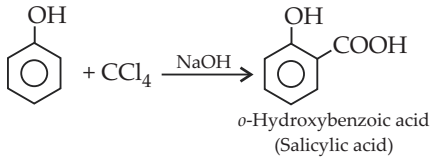
– *Mechanism :* Reaction mechanism involves the electrophilic attack by dichlorocarbene generated from chloroform.

$$CHCl_3 + OH^- \rightleftharpoons CCl_3^- + H_2O$$
$$CCl_3^- \longrightarrow :CCl_2 + Cl^-$$

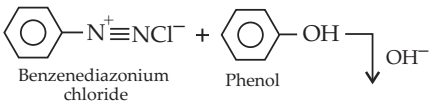
Dichlorocarbene
(Attacking electrophile)

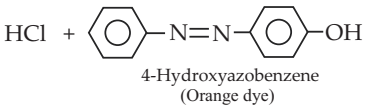


– If the reaction is carried out with carbon tetrachloride (CCl_4) instead of chloroform, *o*-hydroxybenzoic acid (salicylic acid) is formed.

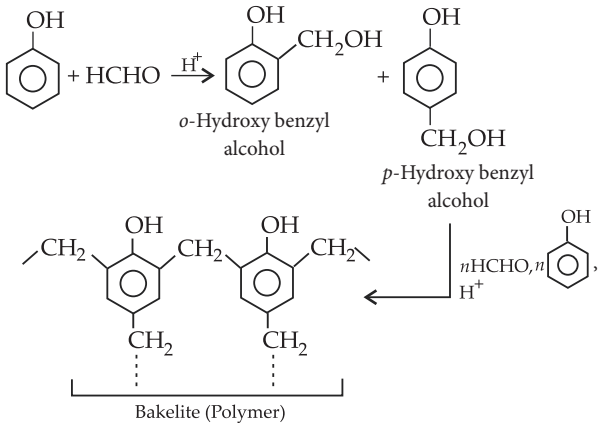


- *Coupling with diazonium salt :*





- *Condensation with formaldehyde :*



KEY POINT

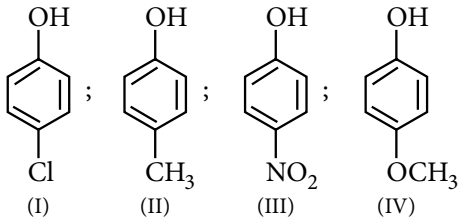
- The H-atoms attached to O, N and S are called *active hydrogens*. Therefore, compounds containing active hydrogens such as alcohols, phenols react with CH_3MgI to give quantitative yield of CH_4 and by knowing the volume of CH_4 evolved at NTP, the number of active hydrogen atoms present in an organic compound can be determined. (*Zerewitinoff's active hydrogen determination*).
- Substituents may either increase or decrease the acidity of phenols depending upon the nature of the substituents whether electron donating or withdrawing.

SELF CHECK

2. The compound that does not liberate CO_2, on treatment with aqueous sodium bicarbonate solution, is
   (a) benzoic acid (b) benzenesulphonic acid
   (c) salicylic acid (d) carbolic acid (phenol).
   (JEE Advanced 2013)

3. The most suitable reagent for the conversion of
$R—CH_2—OH \longrightarrow R—CHO$ is
(a) PCC (Pyridinium chlorochromate)
(b) $KMnO_4$
(c) $K_2Cr_2O_7$
(d) CrO_3 (JEE Main 2014)

4. Arrange the following compounds in order of decreasing acidity.

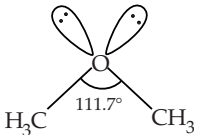


(a) IV > III > I > II (b) II > IV > I > III
(c) I > II > III > IV (d) III > I > II > IV
(JEE Main 2013)

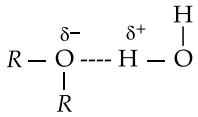
Ethers

- Ethers are compounds which contain an oxygen linked to the alkyl or aryl groups.
- **Classification :**
  - Symmetrical ethers : *ROR*
  - Unsymmetrical or mixed ethers : *ROR'*
- **Nomenclature :** According to IUPAC system of nomenclature, ethers are regarded as hydrocarbon derivatives in which a hydrogen atom is replaced by an —O*R* or —OAr group and the larger *R* group is chosen as the parent hydrocarbon.
- **Structure :** Ethers may be considered as dialkyl derivative of water and their structures can be explained in a similar way :

  - Oxygen atom in ethers is sp^3-hybridised and forms two sigma bonds with two sp^3-hybridised alkyl groups. Oxygen atom has two lone pairs of electrons in remaining two sp^3-hybridised orbitals. C—O—C bond angle in ethers is slightly greater than tetrahedral bond angle due to repulsion between two bulky alkyl groups. In dimethyl ether, C—O—C bond angle is 111.7°.

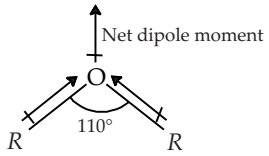


  - As the size of *R* (alkyl group) in ethers increases, van der Waals repulsion increases and hence, bond angle also increases.
- **Physical properties :**
  - Dimethyl ether and ethyl methyl ether are exceptionally gases at room temperature whereas all other ethers are colourless liquids with characteristic etheral smell.
  - Ethers have lower boiling points than isomeric alcohols due to their incapability to form hydrogen bonds and get associated. But lower ethers have slightly higher boiling points than *n*-alkanes of comparable molecular masses due to dipole-dipole interactions. However, higher ethers (containing carbon atoms more than four) have slightly lower boiling points than *n*-alkanes of comparable molecular masses due to weak van der Waals forces of attraction.
  - Ethers are soluble in water to a certain extent due to hydrogen bonding. However, solubility decreases with increase of molecular mass (*i.e.*, increase in the hydrocarbon part). Ethers are fairly soluble in all organic solvents such as alcohol, chloroform, benzene, etc.



H-bonding between ether and water molecules

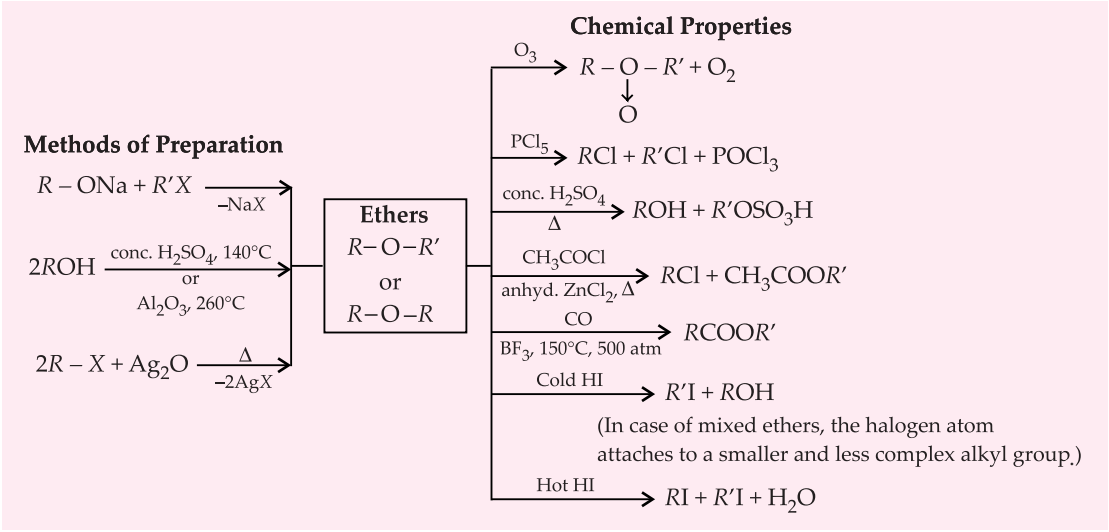
  - Ethers are polar in nature with a dipole moment varying from 1.15 D to 1.30 D. Since ethers have a bent structure, the polarities of two C – O bond do not cancel each other.



Dipolar nature of ethers

  - Ethers have low density. All ethers are lighter than water.

❑ **Preparation and properties :**



KEY POINT

- Williamson's synthesis can be used to prepare ethers containing 2° or 3° alkyl groups through S_N2 mechanism and alkyl halide taken should be 1° as in case of 2° and 3° alkyl halides elimination takes place.
- Dehydration of alcohols for the formation of ethers follows the order : 1° > 2° > 3°
- Alkoxy group in aromatic ethers is *o*, *p*–directing but is less activating than —OH group.
- Ethers form coordinate complexes known as *etherates* with Lewis acids such as BF_3, $AlCl_3$, $FeCl_3$, etc.
- The reaction of HI with ethers form the basis of Zeisel's method for the estimation of methoxy and other alkoxy groups.

SELF CHECK

5. Sodium ethoxide has reacted with ethanoyl chloride. The compound that is produced in this reaction is
   (a) diethyl ether (b) 2-butanone
   (c) ethyl chloride (d) ethyl ethanoate.
   (JEE Main 2011)

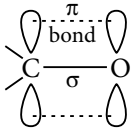
Aldehydes and Ketones

❑ These are the compounds having a carbonyl group > C=O.

❑ Aldehydes contain a free hydrogen attached to carbonyl group while ketones do not have any free hydrogen attached to carbonyl group.

❑ **Nomenclature :** The IUPAC names of open chain aliphatic aldehydes and ketones are derived from the names of the corresponding alkanes by replacing the ending *–e* with *–al* and *–one* respectively.

❑ **Structure :** The carbon of carbonyl group is sp^2 hybridised.



The C—O bond has a double bond character and composed of a σ and a π bond $\left(\overset{\delta+}{C}=\overset{\delta-}{O}\right)$. The bond is polar in character and therefore, it has a dipole moment of 2.3 – 2.8 D. The C—O bond is a resonance hybrid of the following structures :

$$>C=O \leftrightarrow >\overset{+}{C}-\bar{O}$$

❑ **Polar nature of carbonyl group :**

❍ Due to high electronegativity of O-atom, π-electrons cloud of >C=O is unsymmetrical. Oxygen atom acquires a small negative charge and carbon becomes slightly positively charged, hence carbonyl compounds undergo nucleophilic addition reactions.

$$\underset{\mu = 2.3\ D}{>C=O} \longleftrightarrow \underset{\mu = 2.8\ D}{>\overset{+}{C}-\bar{O}}$$

❍ >C=O of carbonyl compounds being polar in nature differs from >C=C< of alkenes and gives nucleophilic addition reactions in contrast to electrophilic addition reactions of alkenes.

❑ Preparation :

Methods of Preparation

Aldehydes and Ketones

1. Oxidation

$RCH_2OH + [O] \xrightarrow{K_2Cr_2O_7 + H_2SO_4\ (dil.)} H_2O + RCHO$

$R_2CHOH + [O] \xrightarrow{K_2Cr_2O_7 + H_2SO_4\ (dil.)} H_2O + R-\overset{\overset{O}{\|}}{C}-R$

2. Oppenauer oxidation

$\begin{matrix} R \\ R' \end{matrix}\!\!>\!CHOH + (CH_3)_2CO \xrightarrow{Al[(CH_3)_3CO]_3} (CH_3)_2CHOH + RCOR'$

3. Catalytic dehydrogenation of alcohols

$RCH_2OH \xrightarrow[300°C]{Cu} RCHO + H_2$

$R_2CHOH \xrightarrow[300°C]{Cu} R_2CO + H_2$

4. Reductive ozonolysis of alkenes

$RCH{=}CHR + O_3 \xrightarrow{CCl_4} RCH\underset{O}{\overset{O}{<}}CHR \xrightarrow[H_2]{Zn,\ H_2O} 2RCHO + H_2O$

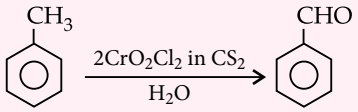
5. Rosenmund's reduction

$RCOCl + H_2 \xrightarrow[S]{Pd,\ BaSO_4} RCHO + HCl$

6. Stephen's reduction

$R-C{\equiv}N \xrightarrow[2.\ Ether\ 3.\ H_2O]{1.\ SnCl_2 + HCl} RCHO + NH_4Cl$

7. Etard's reaction



8. Oxo process

$RCH{=}CH_2 + CO + H_2 \xrightarrow[100°C,\ pressure]{[Co(CO)_4]_2} RCH_2CH_2CHO$

9. Wacker process

$H_2C{=}CH_2 + PdCl_2 + H_2O \xrightarrow[Air\ or\ O_2]{CuCl_2} CH_3CHO + Pd + 2HCl$

10. From alkyl halides

$RCH_2X + (CH_3)_2SO \longrightarrow RCHO + (CH_3)_2S + HX$

$R_2CHX + (CH_3)_2SO \longrightarrow R_2CO + (CH_3)_2S + HX$

11. From lithium and cadmium salts

$2RMgX + CdCl_2 \longrightarrow R_2Cd + MgCl_2 + MgX_2$

$R_2Cd + R'COCl \longrightarrow RCOR' + RCdCl$

$R-COO^-Li^+ + CH_3Li \longrightarrow R-\overset{\overset{OLi}{|}}{\underset{\underset{CH_3}{|}}{C}}-OH \xrightarrow{H^+/H_2O} R-\overset{\overset{OH}{|}}{\underset{\underset{CH_3}{|}}{C}}-OH \xrightarrow{-H_2O} R-\overset{\overset{O}{\|}}{C}-CH_3$

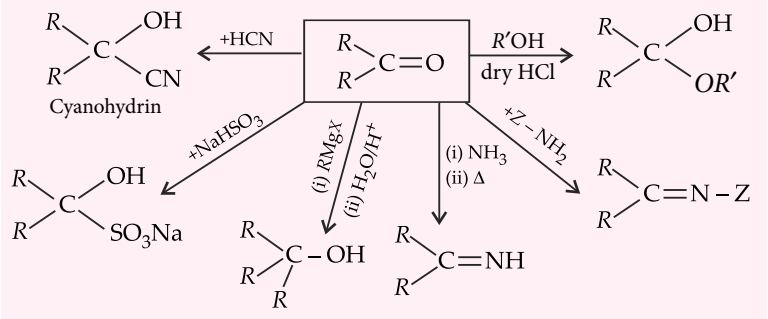
❑ Physical properties :

- Formaldehyde is a gas while other lower aldehydes and ketones are odourless volatile liquids.
- *Solubility :* Lower aldehydes and ketones upto four carbon are soluble in water due to H-bonding between polar (2.3 – 2.8 D) carbonyl groups and polar water molecules.
- Boiling points of aldehydes and ketones are somewhat higher than those of alkanes of comparable molecular masses due to dipole-dipole interactions between the opposite ends of the carbonyl group. However, their boiling points are lower than those of corresponding alcohols and carboxylic acids due to the absence of intermolecular H-bonding in aldehydes and ketones.

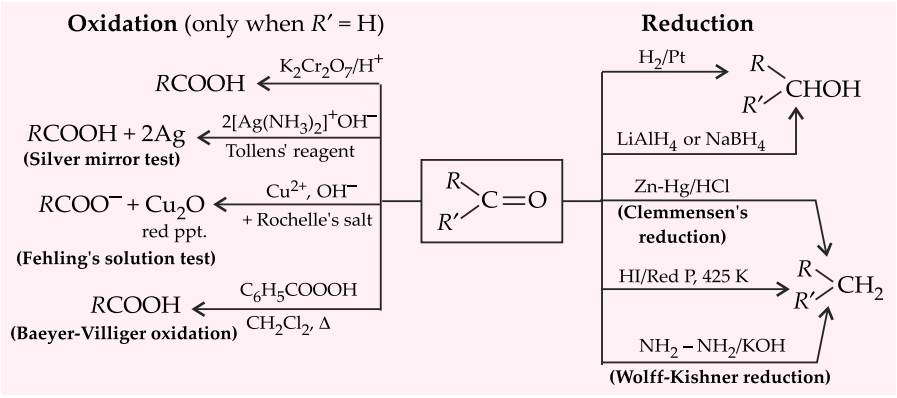
❑ Chemical properties :

- *Nucleophilic addition reactions :* The tendency of nucleophilic addition in carbonyl compounds depends upon the magnitude of positive charge at the carbonyl carbon. Any group attached to carbonyl carbon, if increases electron density over it then its reactivity towards nucleophilic addition will decrease while if a group decreases electron density from carbonyl carbon then the compound undergoes nucleophilic addition readily.
  - *Reactivity order :*

$HCHO > RCHO > PhCHO > R-\overset{\overset{O}{\|}}{C}-R > R-\overset{\overset{O}{\|}}{C}-Ph > Ph-\overset{\overset{O}{\|}}{C}-Ph$



❑ **Other reactions :**



- Ketones are oxidised only under drastic conditions.

$$H_3C-\overset{\overset{O}{\|}}{C}-CH_2-CH_2-CH_3 \xrightarrow{\text{conc. } HNO_3} H_3C-\overset{\overset{O}{\|}}{C}-OH + CH_3-CH_2-COOH$$

(Major)

Carbonyl group is retained by smaller alkyl group (*Popoff's rule)*.

- *Haloform reaction* : Given by methyl ketones (even acetaldehyde).

$$2NaOH + I_2 \longrightarrow NaI + NaIO + H_2O$$

$$RCOCH_3 + 3NaIO \longrightarrow RCOONa + \underset{\text{Iodoform (yellow ppt.)}}{CHI_3} + 2NaOH$$

- *Aldol condensation* : Aldehyde or ketone containing α-hydrogen on heating with dilute NaOH gives β-hydroxycarbonyl compound called *aldol.*

$$2R-\overset{\alpha}{C}H_2-CH=O \xrightarrow{\text{dil. NaOH}} \underset{\text{Aldol}}{R-CH_2-\underset{OH}{CH}-\underset{R}{CH}-CH=O} \xrightarrow[-H_2O]{\Delta} \underset{\alpha,\beta\text{-unsaturated aldehyde}}{R-CH_2-CH=\underset{R}{C}-CH=O}$$

– *Intramolecular aldol condensation* takes place in diketones and gives rise to cyclic products.

– *Crossed aldol condensation* takes place between two different carbonyl compounds (one of which must have one α-hydrogen). For example, between benzaldehyde and an aliphatic aldehyde or ketone (*Claisen-Schmidt condensation* or *Claisen reaction*).

$$C_6H_5-\overset{\overset{O}{\|}}{C}-H + CH_3-\overset{\overset{O}{\|}}{C}-CH_3 \xrightarrow[\text{(ii) } \Delta, -H_2O]{\text{(i) dil. NaOH}} C_6H_5-CH=CH-\overset{\overset{O}{\|}}{C}-CH_3$$

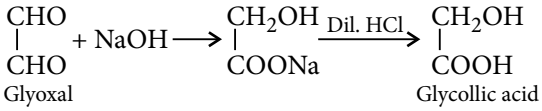
- *Cannizzaro reaction* : Given by aldehydes which have no α-hydrogen atom.

e.g., $2C_6H_5CHO + NaOH \xrightarrow{\Delta} C_6H_5CH_2OH + C_6H_5COONa$

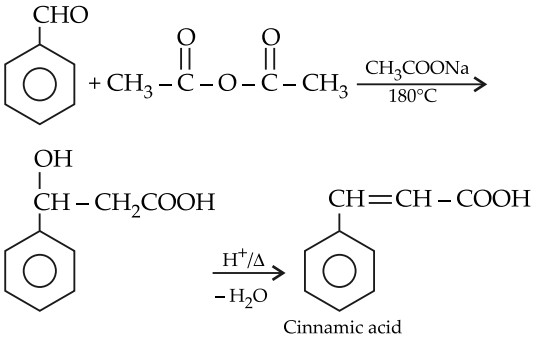
– *Crossed Cannizzaro reaction* : Takes place between two different aldehydes and that aldehyde undergoes oxidation which is more reactive towards the nucleophile while the other aldehyde is reduced.

e.g., $C_6H_5CHO + HCHO \xrightarrow{NaOH, \Delta} C_6H_5CH_2OH + HCOONa$

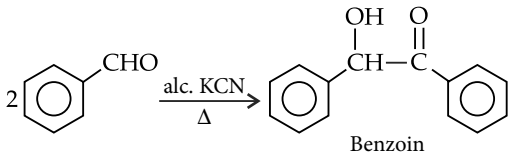
– *Intramolecular Cannizzaro reaction :* Given by dialdehydes having no α-hydrogen.



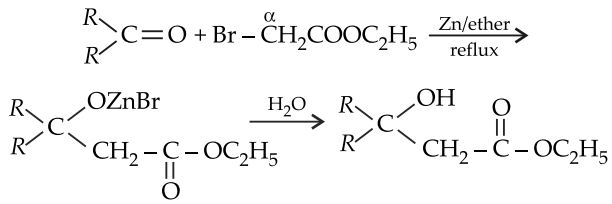
❍ *Perkin condensation :*



❍ *Benzoin condensation :*



❍ *Reformatsky reaction :*



❑ **Distinction between aldehydes and ketones :**

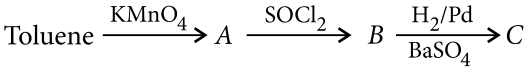
Tests with	Aldehydes	Ketones
Schiff's reagent	Pink colour	No colour
Fehling's solution	Red precipitate	No precipitate is formed.
Tollens' reagent	Black precipitate of silver or silver mirror is formed.	No black ppt. or silver mirror is formed.
2,4-Dinitrophenyl hydrazine	Orange-yellow or red well defined crystals with melting points characteristic of individual aldehydes	Orange-yellow or red well defined crystals with melting points characteristic of individual ketones
Sodium hydroxide	Give brown resinous mass (formaldehyde does not give this test.)	No reaction
Sodium nitroprusside and few drops of sodium hydroxide	A deep red colour (formaldehyde does not respond to this test.)	Red colour which changes to orange.

KEY POINT

- Aromatic aldehydes do not reduce Fehling's solution.
- Ketones do not readily undergo oxidation because a strong C—C bond is to be broken during oxidation.
- The bisulphite addition products are crystalline solids and hence are used for purification of aldehydes and ketones.
- Acetals and ketals being ethers are stable towards alkalies but are hydrolysed by dilute acids to give back the original aldehydes and ketones hence, are used to protect these groups in organic reactions.

SELF CHECK

6. In the following sequence of reactions :



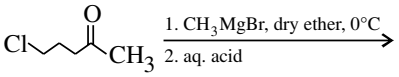
the product (*C*) is

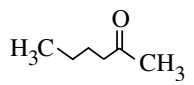
(a) $C_6H_5CH_2OH$ (b) C_6H_5CHO

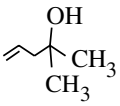
(c) C_6H_5COOH (d) $C_6H_5CH_3$

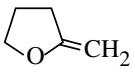
(JEE Main 2015)

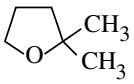
7. The major product in the following reaction is



(a) 

(b) 

(c) 

(d) 

(JEE Advanced 2014)

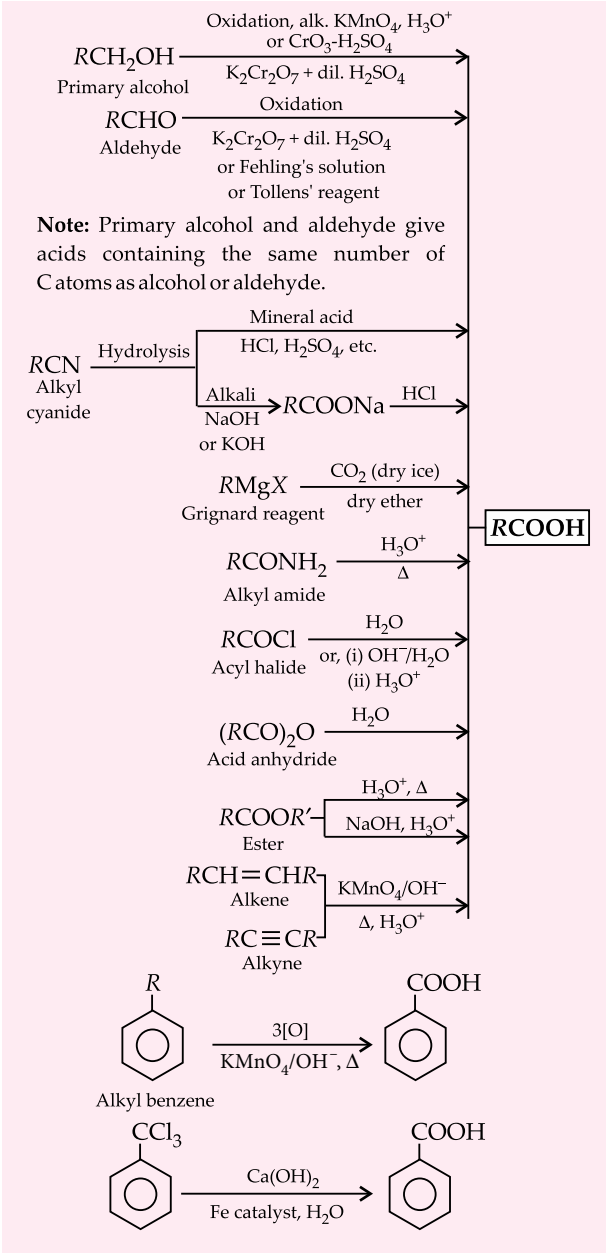
Carboxylic Acids

❑ Carboxylic acids are the compounds having —COOH group as the functional group.

❑ Saturated monocarboxylic acids are commonly known as *fatty acids* because some members of this series were first of all obtained by hydrolysis of fats.

❑ **Classification :** They can be classified as mono, di and tricarboxylic acids according to the number of COOH groups present in the molecule.

❑ Preparation :

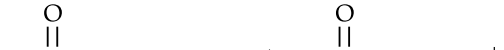


❑ Physical properties :

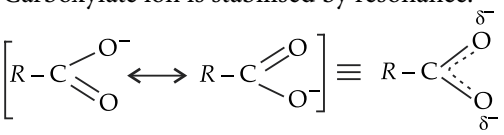
- The first three acids are colourless, pungent smelling liquids. The acids from butyric to nonanoic are oily liquids. Butyric acid has odour of rancid butter. The acids higher than decanoic acid are odourless solids.
- Organic acids have high boiling points. It is due to strong van der Waals forces due to their polar nature.
- Lower members exist as dimers in the aqueous solutions and vapour phase due to intermolecular hydrogen bonding.
- Higher boiling points of acids relative to alcohols are due to the higher degree and strength of hydrogen bonding in them (because of the presence of two oxygen atoms).

❑ Acidic strength and factors affecting it :

- Carboxylic acids ionise in aqueous solution and exist in equilibrium with carboxylate ion.



Carboxylate ion is stabilised by resonance.



- *Effect of substituents on acidic strength :*
  - If an electron withdrawing group is present then there will be dispersal of negative charge on the carboxylate ion, as a result it will be more stable than those acids which do not have electron withdrawing groups. Thus, chloroacetic acid is more acidic than acetic acid. Also in acetic acid, methyl group is electron releasing group and hence electron density at O—H bond increases, as a result removal of proton becomes more difficult *i.e.*, methyl group makes the anion less stable. This is also clear by given data for K_a and pK_a.

    CH_3COOH : $K_a = 1.75 \times 10^{-5}$, p$K_a = 4.76$

    $ClCH_2COOH$: $K_a = 136 \times 10^{-5}$, p$K_a = 2.87$
  - More the effect of electron withdrawing groups the compound will be more acidic. Thus, fluoroacetic acid is more acidic than chloroacetic acid. More the number of halogen atoms, greater would be the dispersal of the negative charge and hence more will be the stabilisation of anion and the compound will be more acidic. Thus,

    $Cl_3CCOOH > Cl_2CHCOOH > ClCH_2COOH > CH_3COOH$

	K_a	pK_a
Cl_3CCOOH	2.32×10^{-1}	0.64
$Cl_2CHCOOH$	5.53×10^{-2}	1.26
$ClCH_2COOH$	1.36×10^{-3}	2.87
CH_3COOH	1.75×10^{-5}	4.76

  - Acidity depends upon the nature of substituents, number of substituents and position of substituents. For example,

- *Nature of substituents :*

  $F—CH_2—COOH > Cl—CH_2—COOH > Br—CH_2—COOH > I—CH_2—COOH$

- *Number of substituents :*

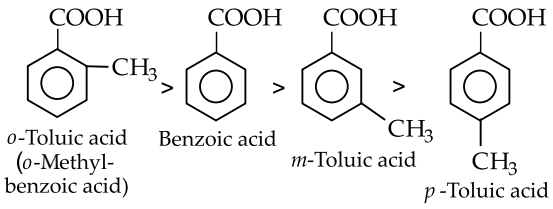
  $Cl_3C—COOH > Cl_2—CH—COOH > Cl—CH_2—COOH$

- *Position of substituents :*

  $—\underset{Cl}{\underset{|}{CH}}—COOH$ (α-position) > $—\underset{Cl}{\underset{|}{CH}}—CH_2—COOH$ (β-position) > $—\underset{Cl}{\underset{|}{CH}}—CH_2—CH_2—COOH$ (γ-position)

- *Relative acidic strength of substituted aromatic acids :*
  - Electron donating substituents (+*I* effect) decrease the acidic strength whereas electron withdrawing groups (–*I* effect) increase the acidic strength of substituted benzoic acids.
  - Benzoic acid is less acidic than formic acid because of electron donating effect (+*I*, +*R*) of phenyl group which is however, weaker than the electron donating (+*I*) effect of methyl group hence we observe the following sequence :

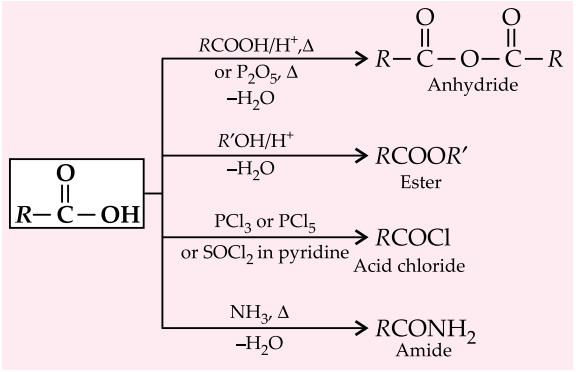
    $H—COOH > C_6H_5—COOH > CH_3—COOH$
  - *Ortho*-substituted benzoic acids (substituent whether electron releasing or electron withdrawing) are more acidic among the three isomers *i.e.*, *ortho*-substituted benzoic acid is more acidic than the *para*- and *meta*-substituted acids. This is called *ortho-effect* and it arises due to combined effect of steric and electronic factors. Thus, we can predict the following order :



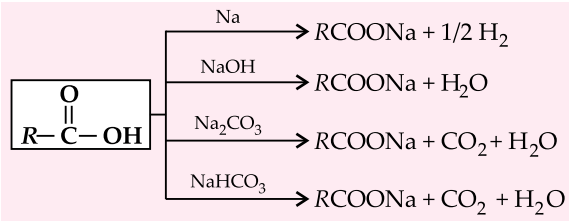
o-Toluic acid (*o*-Methyl-benzoic acid) | Benzoic acid | *m*-Toluic acid | *p*-Toluic acid

Chemical properties :

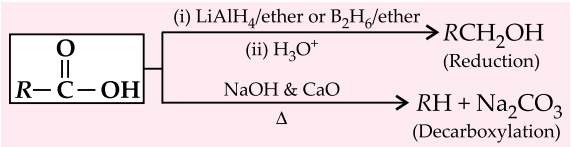
- *Reactions involving cleavage of* C—OH *bond :*



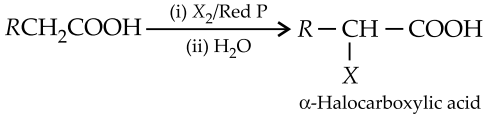
- *Reactions involving cleavage of* O—H *bond :*



- *Reactions involving* –COOH *group :*

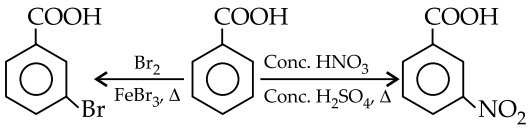


- *Hell-Volhard Zelinsky reaction :*



α-Halocarboxylic acid

- *Ring substitution in aromatic acids :* Aromatic carboxylic acids undergo electrophilic substitution reactions in which the carboxyl group acts as a deactivating and *meta* directing group.



KEY POINT

- A straight chain carboxylic acid with even number of carbon atoms per molecule has a higher melting point than the one with odd number of carbon atoms immediately below and above it.
- *o*–Substituted benzoic acids are usually stronger acids than benzoic acid regardless of the nature of the substituents.

KEY POINT

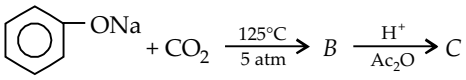
- The acid weakening effect of the electron donating substituents and acid strengthening effect of the electron withdrawing substituents is more pronounced at *p*-than at *m*-positions.
- Benzoic acid is somewhat stronger than simple aliphatic acids because in benzoic acid, the carboxyl group is attached to more electronegative sp^2 hybridised carbon as compared to less electronegative sp^3 hybridised carbon in aliphatic acids.
- Peracids are weaker acids than their corresponding parent acids because acetate ion is stabilised by resonance but peracetate anion is not.

SELF CHECK

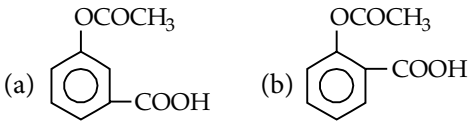
8. In the presence of a small amount of phosphorus, aliphatic carboxylic acids react with chlorine or bromine to yield a compound in which α-hydrogen has been replaced by halogen. This reaction is known as
   (a) Wolff-Kishner reaction
   (b) Etard reaction
   (c) Hell-Volhard-Zelinsky reaction
   (d) Rosenmund reaction.

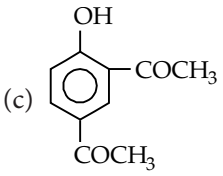
   (JEE Main 2015)

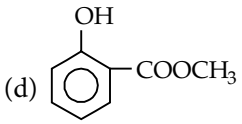
9. Sodium phenoxide when heated with CO_2 under pressure at 125°C yields a product which on acetylation produces *C*.



The major product *C* would be

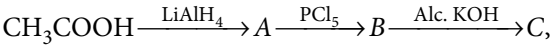






(JEE Main 2014)

10. In the reaction,



the product *C* is
(a) acetyl chloride (b) acetaldehyde
(c) acetylene (d) ethylene.

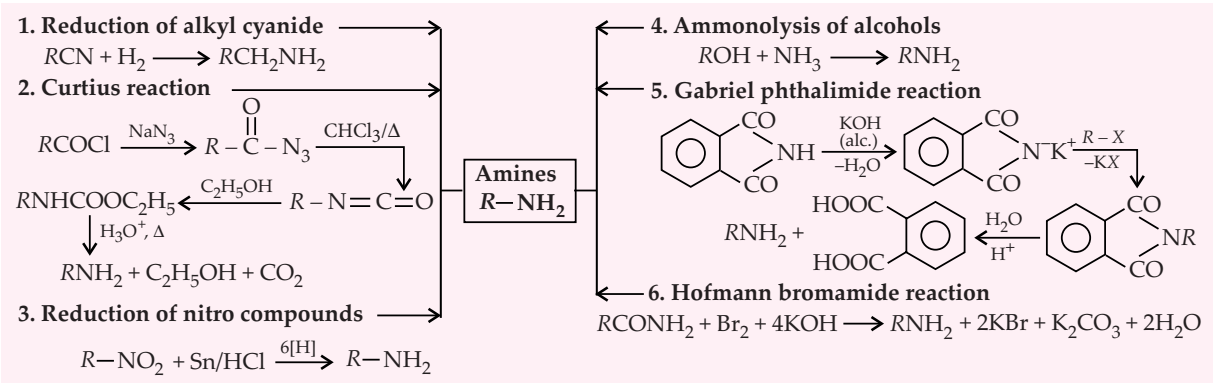
(JEE Main 2014)

ORGANIC COMPOUNDS CONTAINING NITROGEN

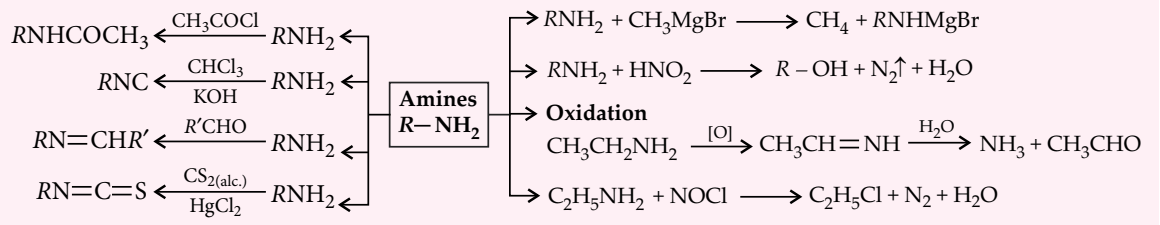
- Introduction
- Classification, Nomenclature, Structure, Preparation and Properties
- Diazonium Salts

TIPS TO REMEMBER

- Amines are the derivatives of NH_3 in which one or more H atoms have been replaced by alkyl or aryl groups.
- **Classification :**
  - *Primary (1°) amines* : These are monoalkyl derivatives of ammonia and contain $-NH_2$ group (amino group).
  - *Secondary (2°) amines* : These are dialkyl derivatives of ammonia and contain $>NH$ group (imino group).
  - *Tertiary (3°) amines* : These are trialkyl derivatives of ammonia and contain $\equiv N$ group (tertiary nitrogen atom).
- **Nomenclature :** In IUPAC system, the primary monoamines are preferably named by replacing the terminal *–e* in the longest alkane chain by amine.
- **Preparation :**



- **Physical properties :**
  - Lower members are gases.
  - Boiling points of amines are higher than the corresponding alkanes due to inter-molecular hydrogen bonding but are lower than corresponding alcohols and acids due to weaker hydrogen bonding.
  - Out of the isomeric amines, tertiary amines have lower boiling points due to absence of hydrogen bonding.
  - Lower amines are soluble in water due to hydrogen bonding but solubility decreases with rise in molecular weight.
- **Chemical properties :**



- **Basic nature of amines :**
  - Amines behave as Bronsted and Lewis bases in organic solvents and vapour phase.
  - Aqueous solutions of $CH_3NH_{2(g)}$ and $C_2H_5NH_{2(g)}$ function as hydroxides $(CH_3\overset{+}{N}H_3)OH^-$.

    $FeCl_3 + 3(CH_3\overset{+}{N}H_3)OH^- \longrightarrow 3(CH_3\overset{+}{N}H_3)Cl^- + Fe(OH)_3\downarrow$
  - Amines readily form salts with acids. H_2PtCl_6 is specially used for determining molecular masses of amines.

    $RNH_2 + HCl \longrightarrow R\overset{+}{N}H_3Cl^-$

    $2RNH_2 + H_2PtCl_6 \longrightarrow (R\overset{+}{N}H_3)_2(PtCl_6)^{2-}\downarrow$
  - In vapour phase and organic solvents, the order of basicity of aliphatic amines is : $3° > 2° > 1° > NH_3$
  - In aqueous medium the order of basicity is :
    — $\underset{(2°)}{(CH_3)_2NH} > \underset{(1°)}{CH_3NH_2} > \underset{(3°)}{(CH_3)_3N}$
    — $\underset{(2°)}{(C_2H_5)_2NH} > \underset{(3°)}{(C_2H_5)_3N} > \underset{(1°)}{C_2H_5NH_2}$
  - Aromatic amines are less basic than ammonia due to shift of lone pair of N-atom towards benzene ring.
  - All ortho derivatives of aniline are weaker bases than aniline (ortho effect) except *ortho*-aminophenol, which is stronger base than aniline.
  - Electron withdrawing groups, like $—NO_2$, —CN, etc. make aniline weaker base and more weaker when present at *p*-position.
  - Electron donating groups, like $—CH_3$, $—OCH_3$, etc., make aniline stronger base and still stronger when present at *p*-position, though at *o*-position, of course, these are weaker than aniline.
  - $PhNH_2 > Ph_2NH > Ph_3N$ (Basic strength)
    $CH_3NH_2 > PhCH_2NH_2 > NH_3$ (Basic strength)
- **Identification of 1°, 2° and 3° amines :**

Test	Primary Amines	Secondary Amines	Tertiary Amines
Reaction with alkyl halides	Combine with three molecules of alkyl halides to form the quaternary salts.	Combine with two molecules of alkyl halides to form the quaternary salts.	Combine with one molecule of alkyl halide to form the quaternary salts.
Reaction with acid chlorides and acid anhydrides	Form monoalkyl substituted amide.	Form dialkyl substituted amide.	No reaction
Reaction with nitrous acid	Form mixture of alcohols and alkenes with evolution of nitrogen gas.	Form yellow oily nitrosoamine characterised by Liebermann's nitroso test.	Form nitrite salt which on decomposition gives mixture of nitrosoamine, alcohols and aldehydes or ketones.

CONCEPT MAP

THE *s*-BLOCK ELEMENTS

Alkali and alkaline earth metals represent the *s*-block of the periodic table and their compounds find wide applications in various industries, medicines and in our daily life.

ALKALI METALS

Atomic and Physical Properties

- Belong to group 1 of the periodic table.
- General electronic configuration : [Noble gas] ns^1
- The atomic and ionic radii increase while going from Li to Cs.
- Ionisation enthalpy decreases down the group.
- Hydration enthalpies of M^+ ions decrease down the group.
- Density increases down the group.
- Flame colouration : Li-Crimson red, Na-Yellow, K-Violet, Rb-Red violet, Cs-Blue
- Low melting and boiling points.
- Form ionic compounds.

Chemical Properties

- All tarnish in air, Li forms oxide (Li_2O), Na forms peroxide (Na_2O_2) and others form superoxides (MO_2), where M = K, Rb, Cs.
- Lithium shows exceptional behaviour forming nitride, Li_3N.
- All form MX type halides with halogens.
- All react with water to form hydroxides and H_2.
- All form hydrides with H_2.
- They are good reductant, Li is most while Na is least powerful.
- Dissolve in liquid NH_3 giving highly conducting deep blue solutions.
- They form salts of oxoacids, like carbonates, sulphates and nitrates.
- Li shows anomalous behaviour due to its small size, high polarising power and absence of *d*-orbitals.

Important Compounds of Sodium

NaCl (Common salt)
- Obtained from sea water.
- Used in the preparation of Na_2O_2, NaOH and Na_2CO_3.

$Na_2CO_3 . 10H_2O$ (Washing soda)
- Prepared by Solvay process.
- Used in water softening, laundering and cleaning.

$NaHCO_3$ (Baking soda)
- Prepared by saturating a solution of Na_2CO_3 with CO_2.
- Used in fire extinguishers and as an antiseptic.

NaOH (Caustic soda)
- Prepared by electrolysis of NaCl in Castner - Kellner cell.
- Used in preparation of soap, paper, artificial silk and in petroleum refining.

ALKALINE EARTH METALS

Atomic and Physical Properties

- Belong to group 2 of the periodic table.
- General electronic configuration : [Noble gas] ns^2
- The atomic and ionic radii of alkaline earth metals are smaller than those of the corresponding alkali metals and increase while going from Be to Ra.
- Ionisation enthalpy decreases down the group.
- Hydration enthalpies of alkaline earth metal ions are larger than those of alkali metal ions and decrease down the group.
- Density decreases from Be to Ca and increases from Ca to Ra.
- Flame colouration : Ca-Brick red, Sr-Crimson, Ba-Apple green, Ra-Crimson
- Higher melting and boiling points than the corresponding alkali metals due to smaller size.
- Form ionic compounds (except Be).

Chemical Properties

- All form monoxides, MO with oxygen and react with water to form hydroxides except Be.
- All form nitrides, M_3N_2.
- All form MX_2 type halides with halogens.
- All form hydrides with H_2 except Be.
- They are good reductant though weaker than the alkali metals and reducing power increases down the group.
- Dissolve in liquid NH_3 to give deep blue-black solutions.
- They form salts of oxoacids, like carbonates, sulphates and nitrates.
- Be shows anomalous behaviour due to small size, high ionisation enthalpy and absence of *d*-orbitals.

Important Compounds of Calcium

$CaSO_4 \cdot 1/2\ H_2O$ (Plaster of Paris)
- Prepared by heating gypsum at 393 K.
- Used in making casts of statues and busts, etc.

CaO (Quick lime)
- Prepared by heating limestone.
- Used in manufacturing cement and dye stuffs.

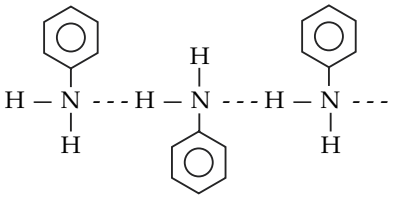
$CaCO_3$ (Calcium carbonate)
- Prepared by passing CO_2 through slaked lime or by addition of Na_2CO_3 to $CaCl_2$.
- Used in manufacturing of CaO, high quality paper, etc. and as an antacid, mild abrasive in toothpaste.

$Ca(OH)_2$ (Slaked lime)
- Prepared by adding water to quick lime.
- Used in the preparation of mortar and in whitewash.

Action of Hinsberg's reagent *i.e.*, benzenesulphonyl chloride ($C_6H_5SO_2Cl$)	Form monoalkyl benzenesulphonamide which on treatment with alkali gives a water soluble salt.	Form dialkylbenzene-sulphonamide which does not dissolve in alkali.	Do not react.

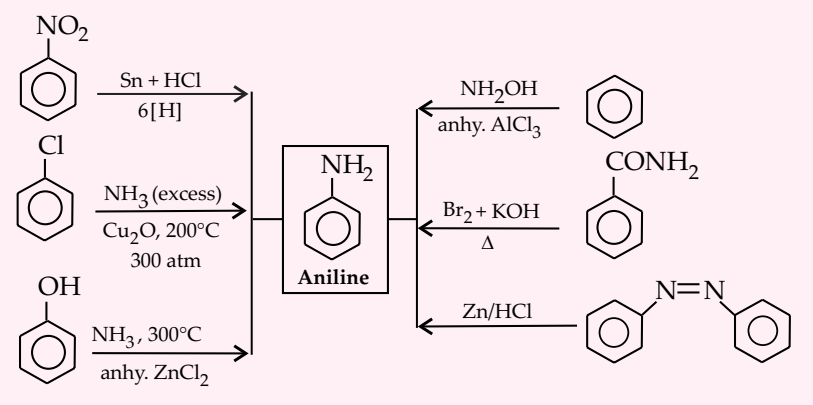
Aniline

- Aniline is an aromatic amino compound in which the nitrogen atom of amino group is directly attached to aromatic ring.
- **Physical properties of aniline :**
  - Fresh aniline is a colourless oily liquid. On standing the colour becomes dark brown due to action of air and light.
  - Its boiling point is 183°C.
  - It is slightly heavier than water.
  - It has a characteristic unpleasant odour.
  - It is slightly soluble in water but readily soluble in organic solvents.
  - It is steam volatile.
  - It is toxic in nature.
  - High boiling point of aniline is due to intermolecular H-bonding.

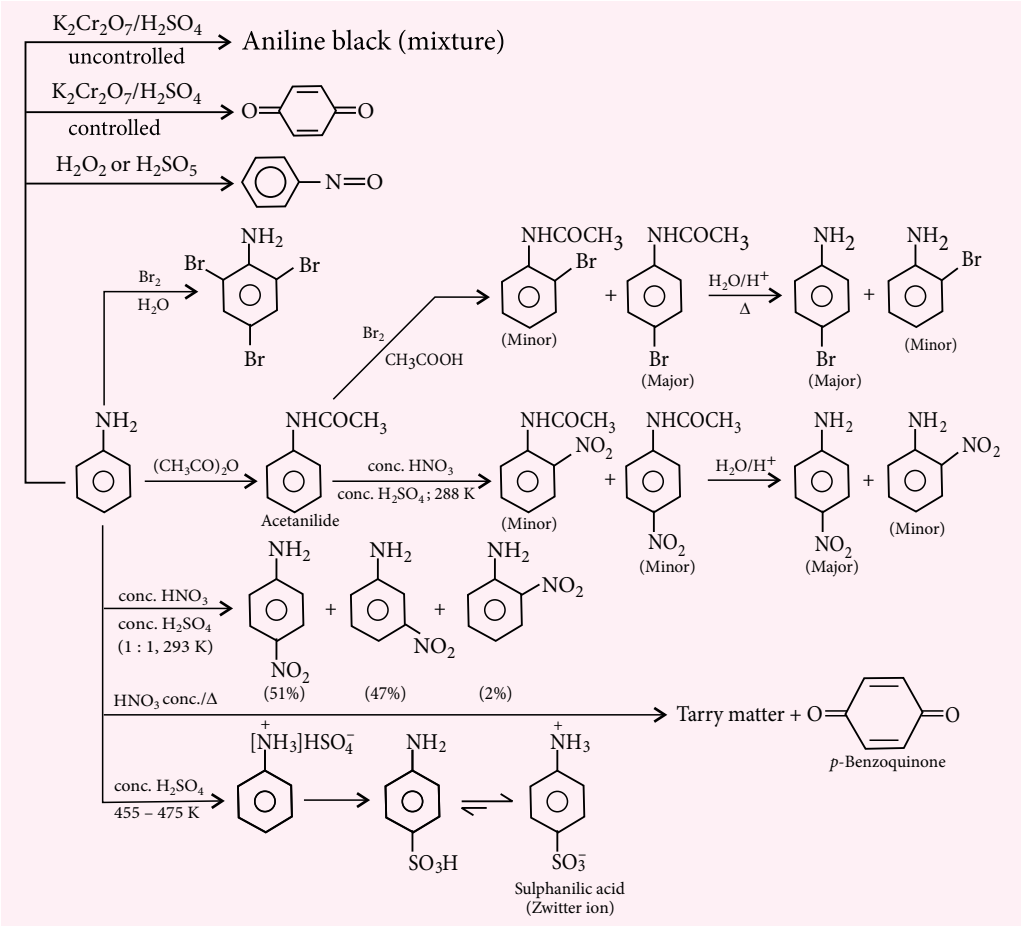


  - *p*-Substituted anilines, being the most symmetric, have the highest melting points. Thus, *p*-toluidine is solid at room temperature (m.pt. 45°C) while *o*- and *m*-toluidines are liquids (b.pt. 201°C and 200°C respectively).

❑ **Preparation :**



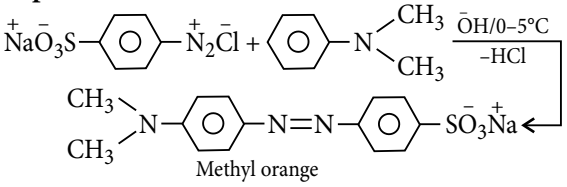
❑ **Chemical properties :**



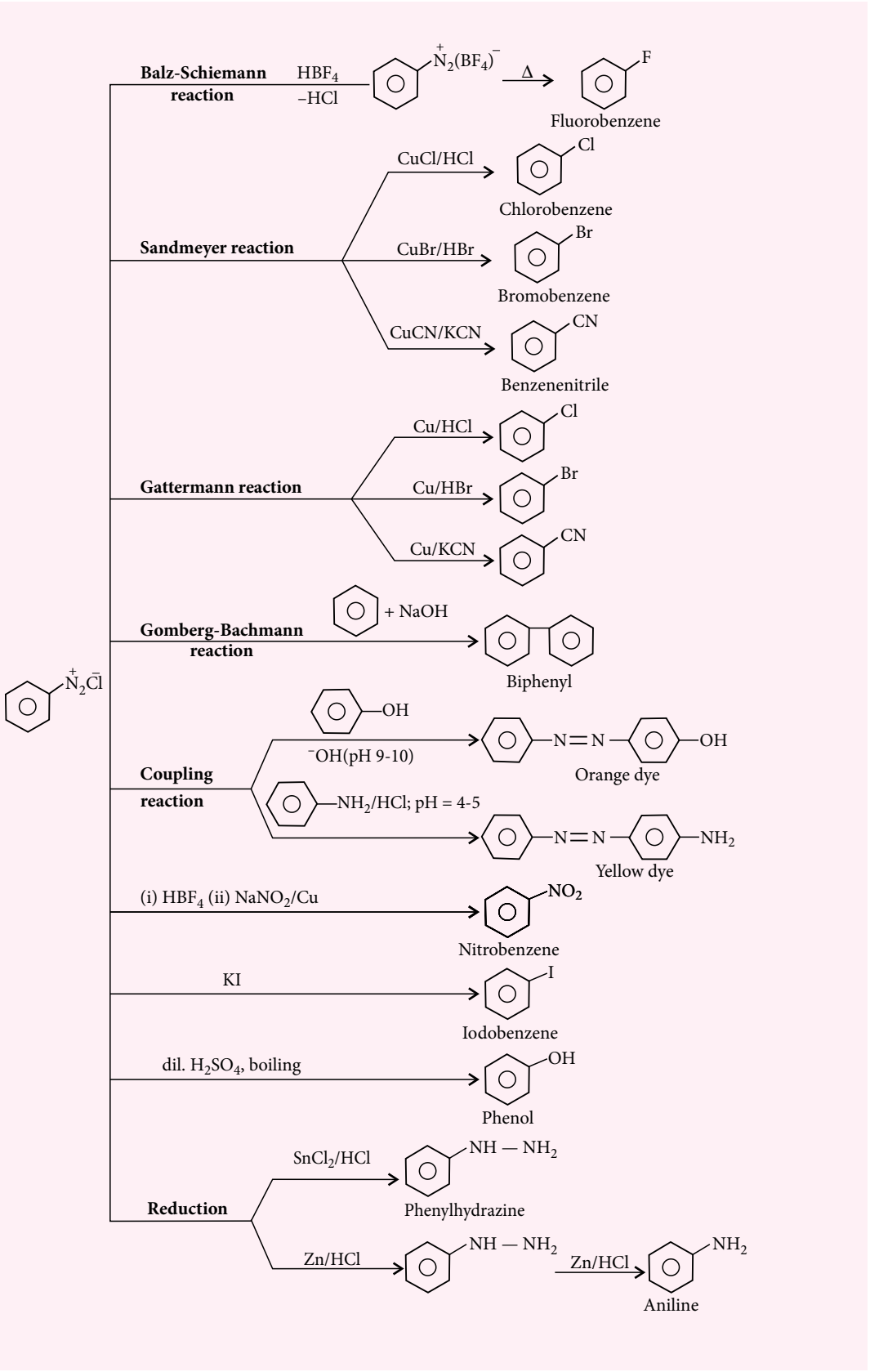
Diazonium salts

❑ The diazonium salts have the general formula $ArN_2^+X^-$ where X^- may be an anion like Cl^-, Br^-, etc. and the group N_2^+ is called *diazonium ion group*.

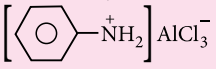
❑ **Preparation :**



❑ Chemical properties :

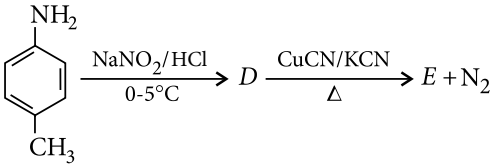


KEY POINT

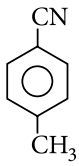
- Friedel-Crafts alkylation and acylation do not occur in aniline because  salt is formed with highly deactivated benzene ring.
- Hofmann bromamide method is used to step down a series because the amine produced from amide has one C-atom less.
- Diazonium salts are never collected in solid state as they explode.
- Amines having chiral N-atom do not show optical isomerism because of rapid flipping of the two possible structures.
- Ortho substituted anilines are generally weaker bases than aniline irrespective of the nature of the group attached to it (*ortho effect*).

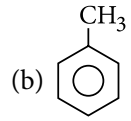
SELF CHECK

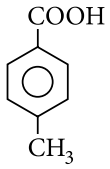
11. In the reaction,

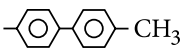


The product (*E*) is

(a) 

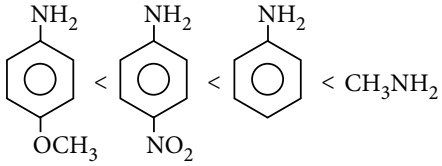
(b) 

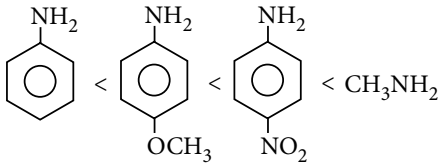
(c) 

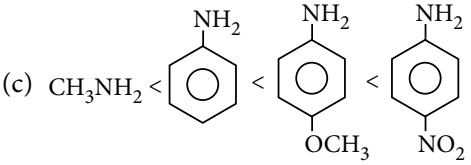
(d) 

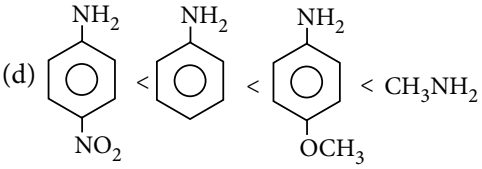
(JEE Main 2015)

12. Arrange the following amines in the order of increasing basicity.

(a) 

(b) 

(c) 

(d) 

(JEE Main 2015)

13. On heating an aliphatic primary amine with chloroform and ethanolic potassium hydroxide, the organic compound formed is
(a) an alkyl isocyanide (b) an alkanol
(c) an alkanediol (d) an alkyl cyanide.
(JEE Main 2014)

14. Considering the basic strength of amines in aqueous solution, which one has the smallest pK_b value?
(a) $C_6H_5NH_2$ (b) $(CH_3)_2NH$
(c) CH_3NH_2 (d) $(CH_3)_3N$
(JEE Main 2014)

15. A compound with molecular mass 180 is acylated with CH_3COCl to get a compound with molecular mass 390. The number of amino groups present per molecule of the former compound is
(a) 6 (b) 2
(c) 5 (d) 4 (JEE Main 2013)

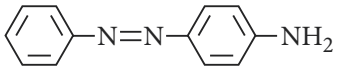
ANSWER KEYS (SELF CHECK)

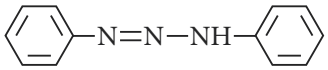
1.	(c)	2.	(d)	3.	(a)	4.	(d)	5.	(d)
6.	(b)	7.	(d)	8.	(c)	9.	(b)	10.	(d)
11.	(a)	12.	(d)	13.	(a)	14.	(b)	15.	(c)

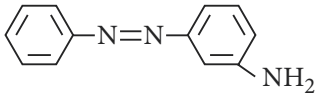
Exam Café

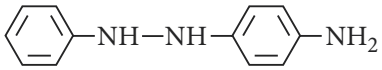
QUESTIONS FOR PRACTICE

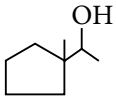
1. When aniline is treated with benzene diazonium chloride at low temperature in weakly acidic medium the final product is

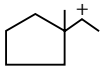
(a) 

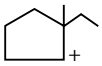
(b) 

(c) 

(d) 

2. Which carbocation is more likely to be formed in the dehydration of  ?

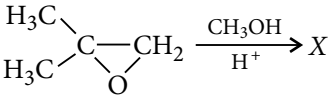
(a) 

(b) 

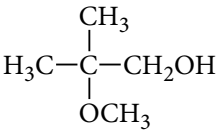
(c) 

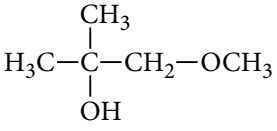
(d) 

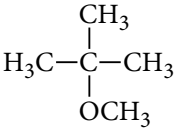
3. In the reaction,

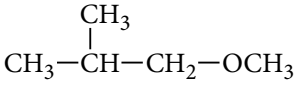


The product '*X*' has the structure

(a) 

(b) 

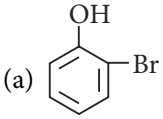
(c) 

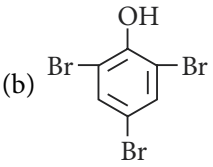
(d) 

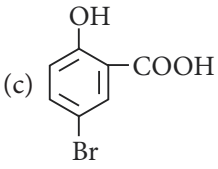
4. C_7H_9N has how many isomeric forms that contain a benzene ring?

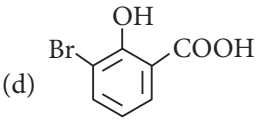
(a) 4 (b) 5 (c) 6 (d) 7

5. When salicylic acid is heated with bromine water, then the product formed is

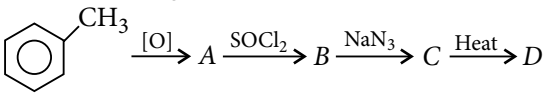
(a) 

(b) 

(c) 

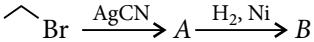
(d) 

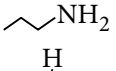
6. In the following sequence of reactions, *D* is



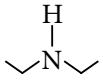
(a) primary amine (b) an amide

(c) phenyl isocyanate (d) a higher hydrocarbon.

7. In the reaction,  the final product '*B*' is

(a) 

(b) 

(c) 

(d)

8. The reagent required to convert propene to propan-1-ol is

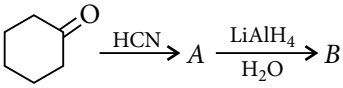
(a) B_2H_6 followed by H_2O_2/NaOH

(b) conc. H_2SO_4 followed by hydrolysis with boiling water

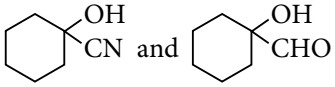
(c) HBr followed by hydrolysis with aqueous KOH

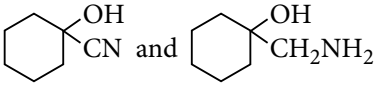
(d) $Hg(OCOCH_3)_2$ followed by reduction with $NaBH_4$.

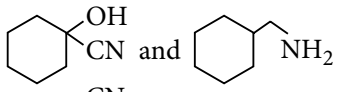
9. In the given reaction,

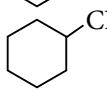
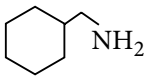


A and *B* will be respectively

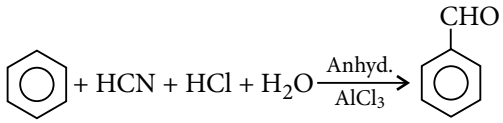
(a) 

(b) 

(c)  and

(d)  and 

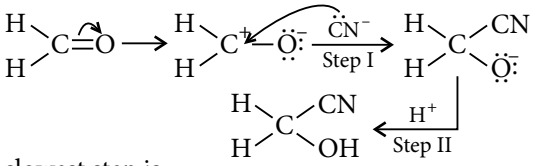
10. The following reaction,



is known as

(a) Perkin reaction
(b) Gattermann reaction
(c) Kolbe's reaction
(d) Gattermann-Koch reaction.

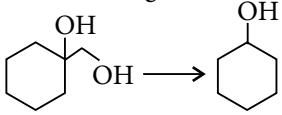
11. In the reaction,



slowest step is

(a) step I (b) step II
(c) both are fast
(d) all the steps take place with equal ease.

12. The following reaction,



can be carried out by

(a) H_2SO_4/Δ, HIO_4 (b) $NaIO_4$, H^+/Δ
(c) HIO_4, $NaBH_4$ (d) H^+/Δ, Zn(Hg – HCl)

13. An organic compound '*A*' has the molecular formula C_3H_6O. It undergoes iodoform test. When saturated with HCl it gives '*B*' of molecular formula $C_9H_{14}O$. '*A*' and '*B*' respectively are

(a) propanal and mesitylene
(b) propanone and mesityl oxide
(c) propanone and 2,6-dimethyl-2,5-hepta-dien-4-one
(d) propanone and mesitylene oxide.

14. Choose the correct statement regarding acidic character of acetic acid, CH_3COOH and peroxyacetic acid, CH_3COOOH.

(a) Peroxyacetic acid is stronger acid than acetic acid since the former has one extra oxygen, an electronegative element.
(b) Peroxyacetic acid is stronger acid than acetic acid because its conjugate base is a weaker base than acetate.
(c) Peroxyacetic acid is weaker acid than acetic acid because its conjugate base is less stable than that of acetate ion.
(d) Both are equally strong.

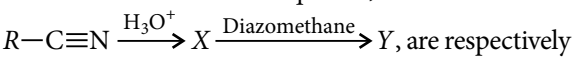
15. Which of the following cannot be prepared by Sandmeyer's reaction?

(a) Chlorobenzene (b) Bromobenzene
(c) Cyanobenzene (d) Fluorobenzene

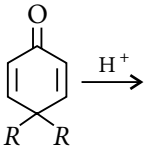
16. The reagent used for the preparation of higher ethers from halogenated ethers is

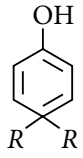
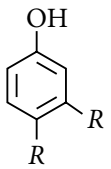
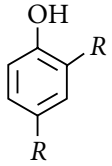
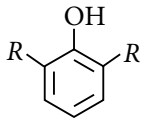
(a) conc. H_2SO_4 (b) sodium alkoxide
(c) dry silver oxide (d) Grignard reagent.

17. *X* and *Y* in the reaction sequence,

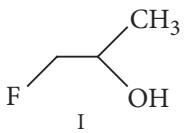


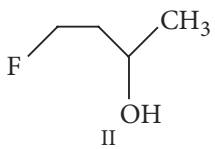
(a) carboxamide, carbonitrile
(b) carboxylic acid, carbonitrile
(c) *R*COOH, *R*COOCH$_3$
(d) *R*CONH$_2$, *R*COCH$_3$

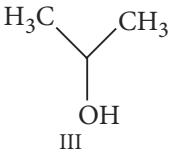
18.  *X*, most likely the compound *X* is

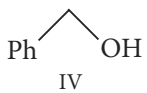
(a) 
(b) 
(c) 
(d) 

19. The order of reactivity of the following alcohols towards conc. HCl is


I

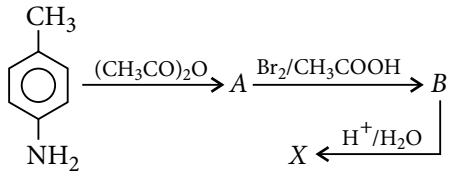

II

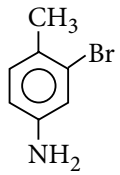

III

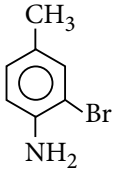

IV

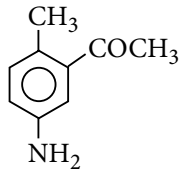
(a) I > II > III > IV (b) IV > III > II > I
(c) IV > II > III > I (d) III > IV > II > I

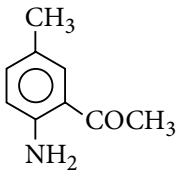
20. Identify *X* in the given reaction sequence.



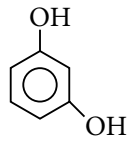
(a) 

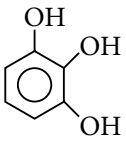
(b) 

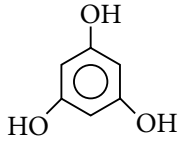
(c) 

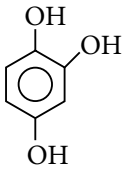
(d) 

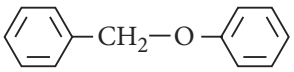
21. Which of the following compounds can react with hydroxylamine?

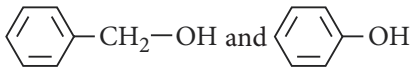
(a) 

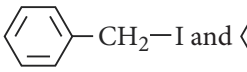
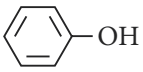
(b) 

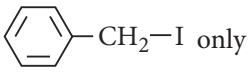
(c) 

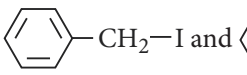
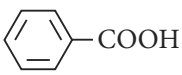
(d) 

22.  on reaction with HI gives

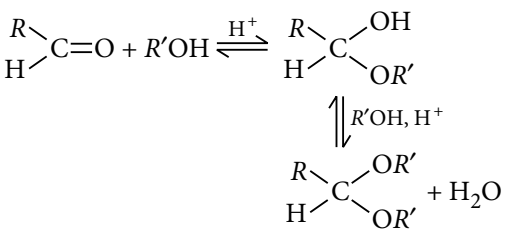
(a)  and

(b)  and 

(c)  only

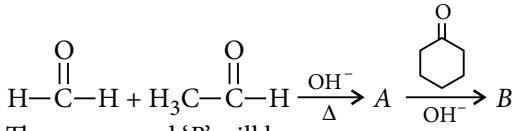
(d)  and 

23. Acetal formation is a reversible reaction,

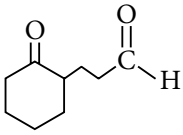


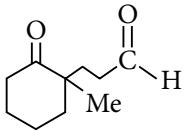
Under what conditions, the reaction can be forced to proceed only in right (forward) direction?

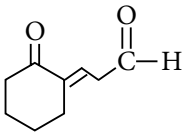
(a) Using excess of alcohol
(b) Using high temperature
(c) Using dilute acid and excess of alcohol
(d) Using dry acid and excess of alcohol

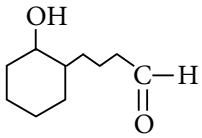
24. 

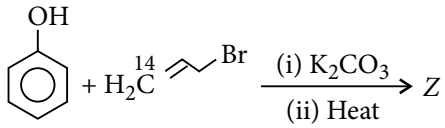
The compound '*B*' will be

(a) 

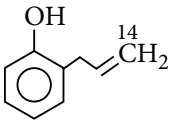
(b) 

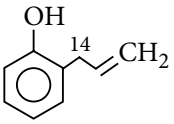
(c) 

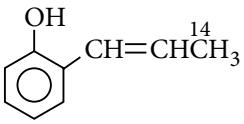
(d) 

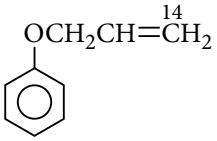
25. 

Here *Z* is

(a) 

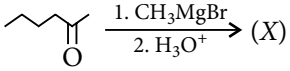
(b) 

(c) 

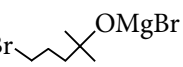
(d) 

26. Aniline when treated with conc. HNO_3 gives
(a) *p*-phenylenediamine (b) *m*-nitroaniline
(c) *p*-benzoquinone (d) nitrobenzene.

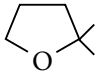
27. In the given reaction,



'*X*' will be

(a) 

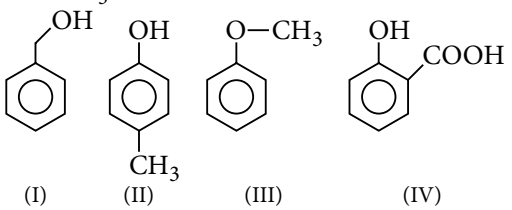
(b) 

(c) 

(d) 

28. The ethereal linkage (–C–O–C–) is cleaved by
(a) HBr (b) HNO_3
(c) both (d) none of these.

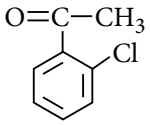
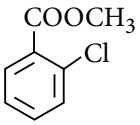
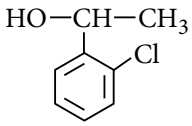
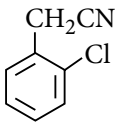
29. Which of the following can give purple colour with neutral $FeCl_3$?



(I) (II) (III) (IV)

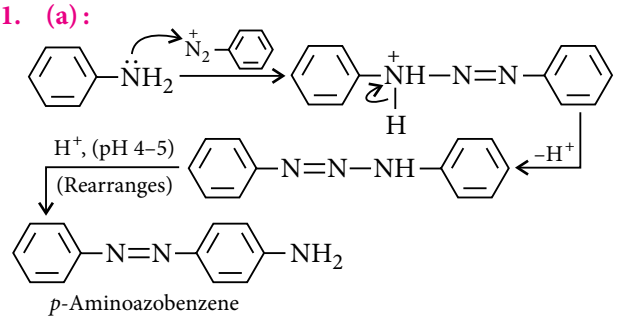
(a) (II) and (IV) (b) (I) and (III)
(c) (II) and (III) (d) (III) and (IV)

30. What is the product of the following series of reactions?

(a) 
(b) 
(c) 
(d) 

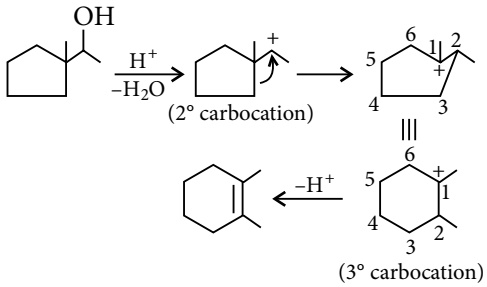
SOLUTIONS

1. (a):



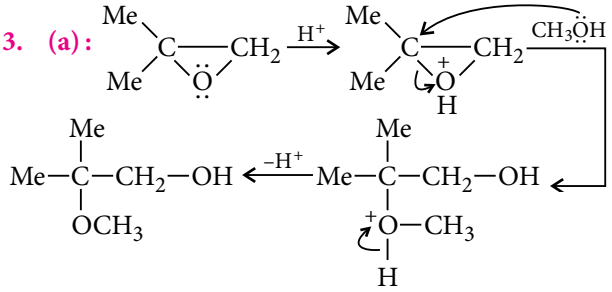
p-Aminoazobenzene

2. (c):

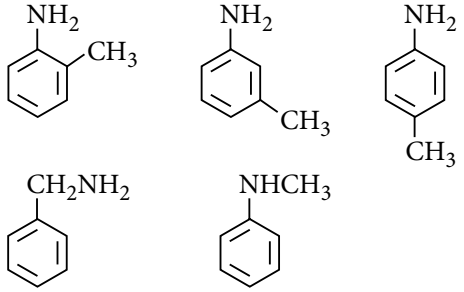


(3° carbocation)

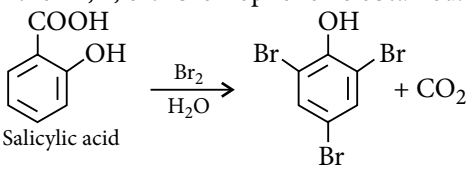
3. (a):



4. (b): C_7H_9N having one benzene ring may be represented as $C_6H_5CH_4N$, CH_4N may be in the form of 1° and 2° amines in the following five isomeric forms :



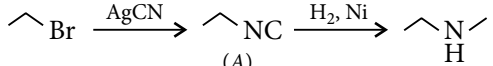
5. (b): When salicylic acid is reacted with bromine water then 2, 4, 6-tribromophenol is obtained.



Salicylic acid 2,4,6-Tribromophenol

In this reaction, salicylic acid on heating with bromine water first undergoes decarboxylation followed by electrophilic substitution reaction. In water, phenol undergoes trisubstitution and not monosubstitution.

6. (c): $C_6H_5CH_3 \xrightarrow{[O]} C_6H_5COOH$ (*A*) $\xrightarrow{SOCl_2} C_6H_5COCl$ (*B*) $\xrightarrow{NaN_3} C_6H_5CON_3$ (*C*) $\xrightarrow[-N_2]{Heat}$ Unstable benzoyl nitrene $\longrightarrow C_6H_5NCO$ Phenyl isocyanate (*D*)

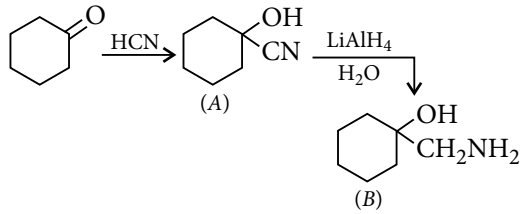
7. (b): 

8. (a): Anti-Markovnikov's hydration is done by hydroboration-oxidation of alkenes,

$$\underset{\text{Propene}}{CH_3CH=CH_2} \xrightarrow[(ii)\ H_2O_2/OH^-]{(i)\ B_2H_6} CH_3CH_2CH_2OH$$

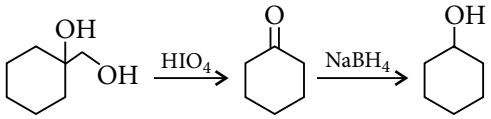
Other three options will lead to Markovnikov's hydration, *i.e.*,

$$CH_3CH=CH_2 \longrightarrow \underset{\text{Propan-2-ol}}{CH_3CHOHCH_3}$$

9. (b): 

10. (b): $C_6H_6 + HCN + HCl \xrightarrow{\text{Anhy. } AlCl_3} [C_6H_5CH{=}NH{\cdot}HCl] \xrightarrow{H_2O,\ \text{boil}} C_6H_5CHO$
Benzaldehyde

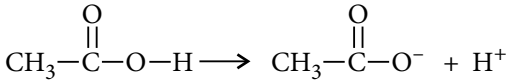
11. (a): Step I involves attack of nucleophile, it is slow step, whereas step II is fast because H^+ reacts with negatively charged oxygen.

12. (c):


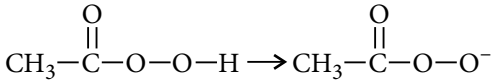
13. (c): Since compound $A(C_3H_6O)$ undergoes iodoform test, it must be CH_3COCH_3 (propanone). Further, the compound '*B*' obtained from '*A*' has three times more the number of carbon atoms as in '*A*' (propanone), '*B*' must be phorone, *i.e.*, 2, 6-dimethyl-2, 5-heptadien-4-one.

$(CH_3)_2C{=}O + H_3CCOCH_3 + O{=}C(CH_3)_2$
A, propanone (3 molecules)

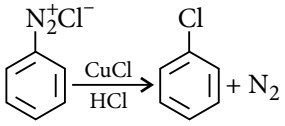
$\xrightarrow{HCl} (CH_3)_2C{=}CHCOCH{=}C(CH_3)_2$
2,6-dimethyl-2,5-heptadien-4-one

14. (c):


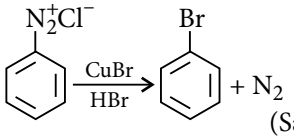
Acetic acid — Conjugate base (Resonance possible, hence stable and weak base)



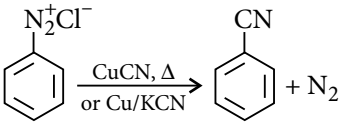
Peroxyacetic acid — Conjugate base (Resonance not possible, hence unstable and strong base)

15. (d): (a)


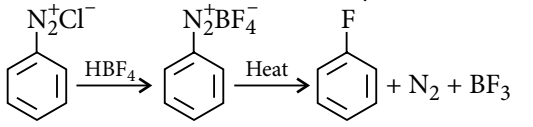
(Sandmeyer's reaction)

(b)


(Sandmeyer's reaction)

(c)


(Sandmeyer's reaction)

(d)


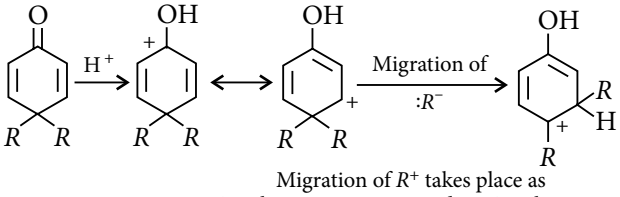
(Balz-Schiemann reaction)

16. (d): $CH_3OCH_3 \xrightarrow{Cl_2,\ h\nu} CH_3OCH_2Cl$
Halogenated ether

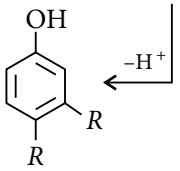
$\xrightarrow[\text{(ii) Dry ether}]{\text{(i) } RMgX} CH_3OCH_2R$
Higher ether

17. (c): $R{-}C{\equiv}N \xrightarrow{H_3O^+} R{-}COOH \xrightarrow{CH_2N_2} R{-}COOCH_3$
(*X*) (*Y*)

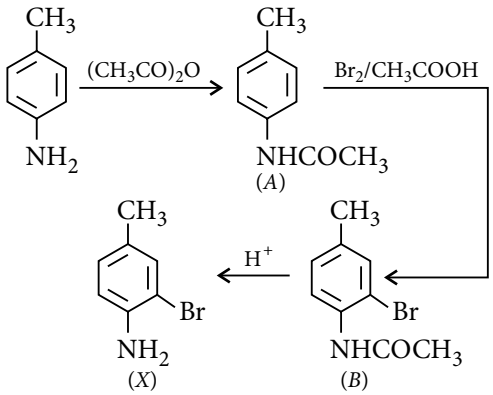
18. (b): Reaction of 4,4-dialkylcyclohexadienone with an acid to form phenol with the migration of one of the alkyl groups to the adjacent carbon is known as dienonephenol rearrangement.



Migration of R^+ takes place as 2° carbocation is converted to 3° carbocation

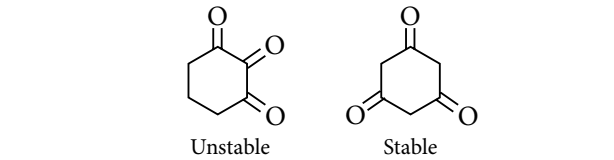


19. (b): Reactivity of alcohols towards, HCl increases with increasing the stability of carbocation.

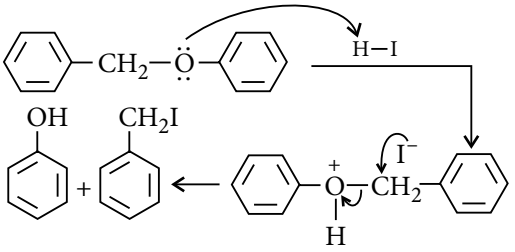
20. (b):


(—$NHCOCH_3$ is more electron releasing group than —CH_3 group.)

21. (c): We know that phenols show keto-enol tautomerism and the stability of the keto form depends upon the number of keto groups (more the number of keto groups, higher will be stability of the keto tautomer). Thus, trihydric phenols should exist in keto form in considerable amount but only when the two keto groups are not on adjacent carbon atoms which decreases the stability due to positive charge on adjacent carbon atoms.

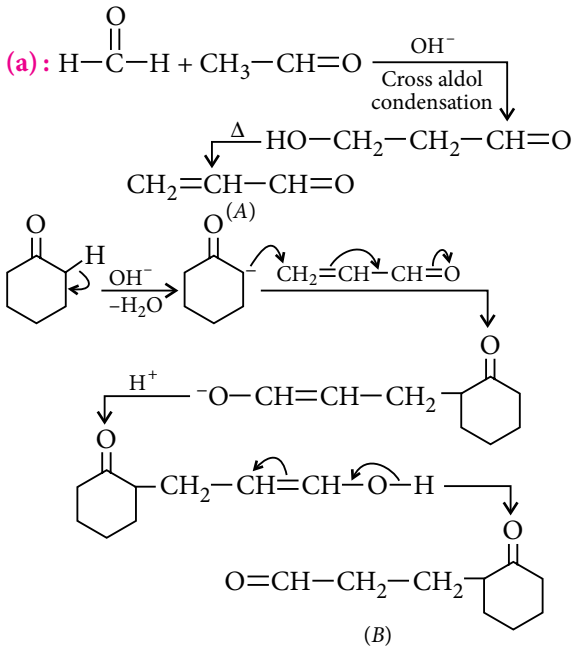


22. (b):

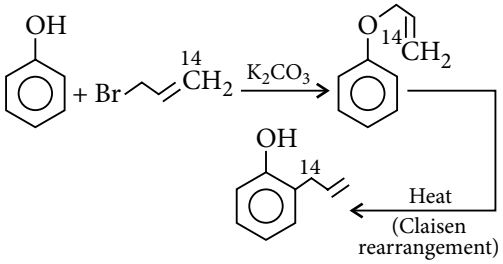


23. (d): Being reversible reaction, the backward reaction *i.e.*, acetal-hemiacetal step can be restricted by minimising water content, *i.e.*, by using dry HCl. The step hemiacetal - aldehyde can be restricted by using excess of alcohol.

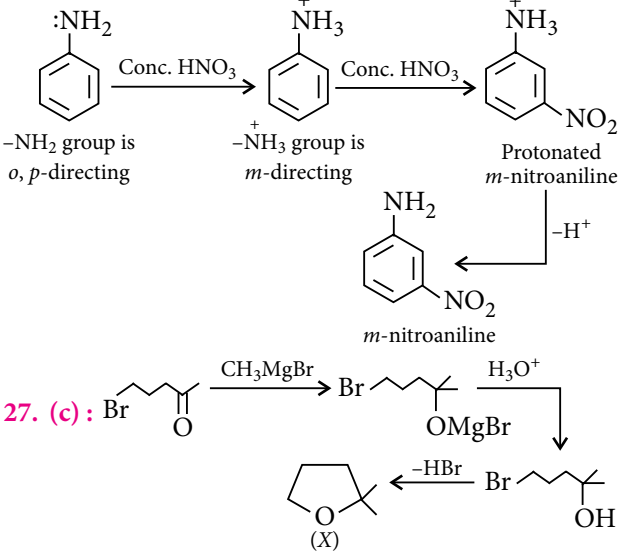
24. (a):



25. (b):



26. (b): Although – NH_2 group is *o,p*-directing but in presence of conc. HNO_3, it undergoes protonation to form $-\overset{+}{N}H_3$ which being electron - deficient, becomes *m*-directing.

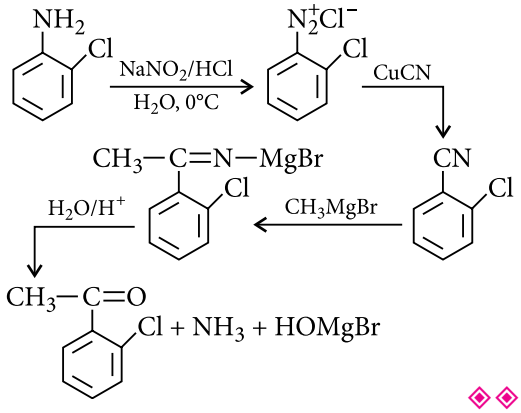


27. (c):

28. (a): Cleavage of ethers by acid is a nucleophilic substitution reaction which is possible only in case of HI and HBr, but not in HNO_3 and H_2SO_4. The reason being the fact that I^- and Br^- are less sterically hindered in attacking the substrate in comparison to NO_3^- and SO_4^{2-}.

29. (a)

30. (a):



ACE YOUR WAY CBSE XII

Series 8

CHAPTERWISE PRACTICE PAPER : BIOMOLECULES | POLYMERS | CHEMISTRY IN EVERYDAY LIFE

Time Allowed : 3 hours | Maximum Marks : 70

GENERAL INSTRUCTIONS

(i) All questions are compulsory.
(ii) Q. no. 1 to 5 are very short answer questions and carry 1 mark each.
(iii) Q. no. 6 to 10 are short answer questions and carry 2 marks each.
(iv) Q. no. 11 to 22 are also short answer questions and carry 3 marks each.
(v) Q. no. 23 is a value based question and carries 4 marks.
(vi) Q. no. 24 to 26 are long answer questions and carry 5 marks each.
(vii) Use log tables if necessary, use of calculators is not allowed.

1. Name the monomer of cellulose.

2. Name a polymer used in the manufacture of paints and lacquers.

3. Valium and serotonin belong to which class of drugs?

4. Why is ethanol added to soaps?

5. What is a gene?

6. What do you mean by specificity and selectivity of enzymes?

7. Why are cimetidine and ranitidine better antacids than $NaHCO_3$ or $Mg(OH)_2$ or $Al(OH)_3$?

8. What do you mean by reducing and non-reducing sugars? Give one example of each.

9. **(i)** Write the full name and commercial name of PTFE. Give some of its uses.
(ii) Arrange the following in the order of increasing intermolecular forces : thermoplastics, fibres, elastomers.

10. **(i)** What are food preservatives?
(ii) What do BHT and BHA stand for? What are their uses?

OR

(i) What is the chemical composition of cationic detergents?
(ii) Why soaps cannot be used in hard water?

11. **(i)** In what way enzymes differ from ordinary catalysts?
(ii) What are enzyme inhibitors?

12. **(i)** What is the structural difference between HDP and LDP? How does the structure account for different behaviour, nature and hence the use of the polymer?
(ii) Write the name and molecular structure of the monomer of natural rubber.

13. **(i)** Sulpha drugs work like antibiotics but they are not antibiotics. Explain.
(ii) What are chemical messengers?
(iii) What is the tincture of iodine?

14. **(i)** Amino acids may be acidic, alkaline or neutral. Justify the statement.
(ii) What are the essential and non-essential amino acids? Name one of each type.

OR

(i) What are vitamins? Classify them into water soluble and insoluble vitamins.

(ii) Vitamin pills should not be taken without the advice of doctors. Why?

15. (i) Why is aspartame used in cold foods and drinks only?

(ii) How do detergents cause water pollution? What remedy is suggested to prevent this pollution?

16. (i) Which type of biomolecules have some structural similarity with synthetic polyamides? What is this similarity?

(ii) Write two polymers in each case which are (a) thermoplastic type (b) used as fibres.

(iii) What is the role of benzoyl peroxide in the polymerisation of ethene?

17. (i) Explain what is meant by glycosidic linkage?

(ii) What are nucleotides? Name two classes of nitrogen containing bases found in nucleotides.

18. (i) What is the scientific explanation for the feeling of depression?

(ii) Explain how do tranquilizers control the feeling of depression? Give two examples of tranquilizers.

19. (i) What are soft soaps?

(ii) Antacids and antiallergic drugs interfere the functions of histamine. Why do they not interfere with the functions of each other?

(iii) Explain the role of allosteric site in enzyme inhibition?

20. (i) Why is purest monomer used in free radical polymerisation always?

(ii) What are polyamide polymers? Give two examples.

(iii) What is vulcanisation of rubber?

21. (i) What do you mean by denaturation of protein? Give two examples of denaturation.

(ii) How is glucose prepared from the cane sugar in the laboratory?

22. (i) When RNA is hydrolysed, there is no relationship among the quantities of different bases formed. What does this fact suggest about the structure of RNA?

(ii) How many hydrogen bonds are formed between different pairs of bases in nucleic acids?

(iii) Amino acids exist as zwitter ion but *o*- and *p*-aminobenzoic acids do not. Why?

23. Sameer's father has to take injections of insulin due to diabetes. One day, he decided to collect more information about insulin and to find out whether it is safe to use it frequently for his father? For that he searched about insulin on internet and he got to know that it is nothing but a hormone which is also secreted by pancreas in our body.

(i) What values are shown by Sameer?

(ii) Why does a diabetic person need to take insulin injections?

(iii) Identify the class of hormones to which insulin belongs.

(iv) Give another example of a hormone which belongs to the same class and state its function in our body.

24 (i) How can you differentiate between addition and condensation polymerisation?

(ii) Distinguish between the terms homopolymer and copolymer and give an example of each.

(iii) Write the reaction involved in the preparation of terylene.

OR

(i) Which of the following polymers soften on heating and harden on cooling? What are the polymers with this property collectively called? What are the structural similarities between such polymers?

(a) Bakelite

(b) Urea-formaldehyde resin

(c) Polythene

(d) Polyvinyls

(e) Polystyrene

(ii) Explain the difference between chain growth and step growth polymerisation.

25. (i) Write a short note on :

(a) anti-fertility drugs

(b) antacids

(ii) Why is chlorine added to swimming pools?

OR

(i) What are detergents? Give their scheme of classification. Why are detergents preferred over soaps?

(ii) What are disinfectants and antiseptics? Give one example of each.

26. **(i)** What are nucleic acids? Mention their two important functions.

(ii) What happens when *D*-glucose is treated with the following reagents?

(a) Bromine water

(b) HNO_3

OR

(i) Differentiate between globular and fibrous proteins.

(ii) State two main functions of carbohydrates.

SOLUTIONS

1. β-*D*-Glucose is the monomer of cellulose.

2. Glyptal is used in the manufacture of paints and lacquers.

3. Valium and serotonin are tranquilizers.

4. Ethanol is added to soaps in order to make them transparent.

5. The segment of a DNA molecule which codes for a specific protein is called a gene.

6. Specificity of enzymes means one enzyme cannot catalyse more than one reaction *e.g.*, urease catalyses the hydrolysis of urea only. Selectivity of enzymes means that they direct a reaction to yield a particular product only.

7. $NaHCO_3$ makes the stomach alkaline and triggers the production of more acid. $Mg(OH)_2$ and $Al(OH)_3$ being insoluble, are better than $NaHCO_3$ and do not increase the pH. However, these treatments control only symptoms and not the cause. Cimetidine and ranitidine prevent the interaction of histamine with the receptors present in the stomach wall. This results in the release of lesser amount of acid.

8. A carbohydrate which reduces Tollens' reagent and Fehling's solution due to the presence of free aldehydic or ketonic group is called reducing sugar *e.g.*, maltose. A carbohydrate which does not reduce Tollens' reagent and Fehling's solution due to the absence of free aldehydic or ketonic group is called non-reducing sugar *e.g.*, sucrose.

9. **(i)** PTFE is polytetrafluoroethene and its commercial name is teflon.

It is used in making oil seals and gaskets and also used for non-stick surface coated utensils.

(ii) Elastomers < thermoplastics < fibres

10. **(i)** Chemical compounds used to prevent spoilage of food due to microbial growth are called food preservatives *e.g.*, sodium benzoate.

(ii) BHT is butylated hydroxytoluene and BHA is butylated hydroxyanisole. They are used as antioxidants.

OR

(i) Cationic detergents are quaternary ammonium salts of amines with acetates, chlorides or bromides as anions.

(ii) Hard water contains calcium and magnesium ions. These ions on reaction with sodium or potassium soaps form gummy mass which gets adhered onto the fibre of the cloth.

$$2C_{17}H_{35}COONa + CaCl_2 \rightarrow 2NaCl + (C_{17}H_{35}COO)_2Ca$$

Insoluble calcium stearate (soap)

11. **(i)**

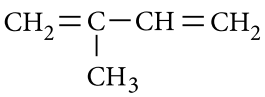
Enzymes	Catalysts
Enzymes are biochemical catalysts having high molecular masses.	Catalysts are simple inorganic molecules having low molecular masses.
Enzymes are required in very small quantities and work only at optimum temperature and pH.	Catalysts are less sensitive to temperature and pH.

(ii) The drugs (chemicals) which inhibit the activities of enzymes by blocking the active (binding) site of an enzyme in such a way that it cannot bind the substrate or cannot show catalytic activities, are known as enzyme inhibitors.

12. **(i)** Low density polythene (LDP) has highly branched structure. LDP is chemically inert, tough but flexible and poor conductor of electricity. Hence, it is used for insulation of electric wires and in manufacturing squeeze bottles, toys and flexible pipes.

High density polythene (HDP) is a linear molecule and has high density which makes it tougher and harder. Hence, it is used in manufacturing buckets, jars, etc.

(ii) Monomer of natural rubber :



Isoprene

13. (i) Sulpha drugs can kill or prevent the growth of microorganisms like antibiotics but they are not antibiotics in the sense that these are not produced by microorganisms.

(ii) Inside our body, messages between two neurons and that between neurons to muscles are communicated through certain chemicals called chemical messengers.

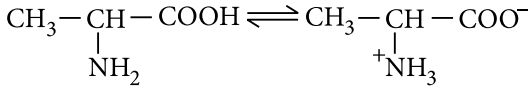
(iii) A 2-3% solution of iodine in alcohol water mixture used as an antiseptic is known as tincture of iodine.

14. (i) Amino acids have two types of groups :

$-NH_2$ basic

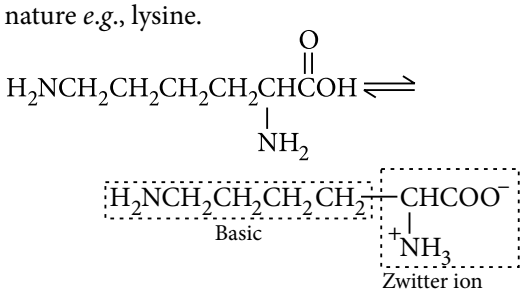
$-COOH$ acidic

Case I : In α-amino acids like glycine, alanine, etc. there is formation of dipolar ion called zwitter ion.

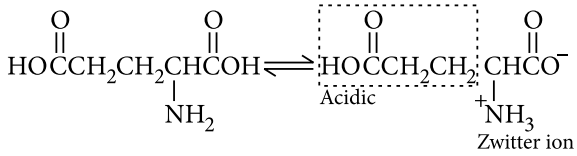


In such case if pK_a(acid) = pK_b (base) then amino acid shows neutral behaviour.

Case II : If in an amino acid, there are two basic parts and one acidic part it will show basic nature *e.g.*, lysine.



Case III : If in an amino acid, there are two acidic parts and one basic part it will show acidic nature *e.g.*, glutamic acid.



(ii) Amino acids which cannot be synthesised in the body and must be obtained through diet are called essential amino acids. Valine is an essential amino acid.

The amino acids which can be synthesised in the body are known as non-essential amino acids. Serine is a non essential amino acid.

OR

(i) Vitamins are the organic compounds required in the diet in small amounts to perform specific biological functions for normal maintenance of optimum growth and health of the organism.

Water soluble vitamins : Vitamin B-complex *i.e.*, B_1, B_2, B_5, B_6 and vitamin C are water soluble vitamins. These vitamins must be supplied regularly through diet because they cannot be stored (except vitamin B_{12}) in our body, as they are readily excreted through urine.

Water insoluble, or fat soluble vitamins : Vitamin A, D, E and K are water insoluble vitamins. These are soluble in fat and oils. These vitamins are stored in liver and adipose (fat storing) tissues.

(ii) Excess of vitamins is harmful and can cause hypervitaminoses so, vitamin pills should not be taken without doctor's advice.

15. (i) Aspartame is decomposed at cooking temperature hence, its use is limited to cold foods and cold drinks only.

(ii) If detergent is highly branched, bacteria cannot degrade it easily. Slow degradation of detergents lead to their accumulation and causes water pollution. Straight chain detergents are biodegradable hence, pollution is prevented by using more and more straight chain hydrocarbon containing detergents.

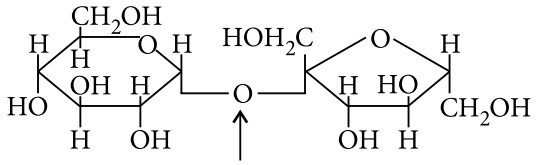
16. (i) Proteins have structural similarity with synthetic polyamides (nylons) as both contain amide linkages.

(ii) (a) Thermoplastic type : Polystyrene and polyvinyl chloride are thermoplastic polymers.

(b) Fibres : Nylon-6, 6 and terylene are fibres.

(iii) Benzoyl peroxide produces free radical which initiates the chain reaction.

17. (i) A linkage between two monosaccharide units through oxygen atom is called glycosidic linkage.



(ii) Nucleotides are the monomeric units of nucleic acids containing a five carbon sugar attached with a phosphate group and a nitrogen containing heterocyclic base.
The two classes of nitrogen containing bases found in nucleotides are purines and pyrimidines.

18. (i) A person suffers from depression due to low level of noradrenaline. Noradrenaline is a neurotransmitter that plays a role in mood changes. Low levels of noradrenaline lowers the signal sending activity and the person feels depressed.

(ii) Tranquilizers are a class of chemical compounds used for the treatment of stress and mild mental diseases. These drugs inhibit the enzymes which catalyse the degradation of noradrenaline. If the enzyme is inhibited, this neurotransmitter noradrenaline is slowly metabolised and can activate its receptor for longer period of time thus counteracting the effect of depression. Iproniazid and phenelzine are two such drugs. They are called antidepressant drugs.

19. (i) Soaps prepared by using potassium hydroxide in place of sodium hydroxide are called soft soaps as they are soft to the skin.

(ii) Antacids and antiallergic drugs work on different receptors and are highly specific in nature. So, they do not interfere with the functions of each other.

(iii) Binding of a drug molecule at the allosteric site changes the shape of the active site of the enzyme in such a way that the natural substrate cannot recognise it. As a result, the chemical reaction is inhibited.

20. (i) If impurity is present then alkene monomers may act as chain transfer agents or chain inhibitors. Therefore, the monomer in free radical polymerisation is always taken as pure.

(ii) Those polymers in which amide (–CONH–) linkage is present in the chain are called polyamides, *e.g.*, nylon 6,6 and nylon 6.

(iii) The process of heating a mixture of raw rubber with sulphur and an appropriate additive at a temperature range between 373 K to 415 K so that it gets stiffened is called vulcanisation of rubber.

21. (i) When a protein in its native form, is subjected to physical change like change in temperature or chemical change like change in pH, the hydrogen bonds get disturbed. Due to this, globules unfold and helix gets uncoiled and protein loses its biological activity. This is called denaturation of proteins.
The coagulation of egg white on boiling and curdling of milk which is caused due to the formation of lactic acid by the bacteria present in the milk are two common examples of denaturation.

(ii) Glucose is prepared from the cane sugar (sucrose) by the hydrolysis of an alcoholic solution of cane sugar with a 4% solution of HCl in alcohol.

$$\underset{\text{Sucrose}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow{H^+} \underset{\text{Glucose}}{C_6H_{12}O_6} + \underset{\text{Fructose}}{C_6H_{12}O_6}$$

Glucose being almost insoluble in alcohol, crystallises on cooling while fructose would remain in solution because it is comparatively more soluble in alcohol.

22. (i) When a RNA molecule is hydrolysed then there is no relationship between the quantities of four bases *viz.* adenine (A), guanine (G), cytosine (C), and uracil (U). This fact suggests that RNA has single stranded structure.

(ii) Two hydrogen bonds are formed between adenine and thymine (A⋮⋮T) and three hydrogen bonds are formed between guanine and cytosine (G⋮⋮⋮C).

(iii) *o* - and *p* - aminobenzoic acids contain both weakly acidic (–COOH) and weakly basic ($-NH_2$) group due to the electron withdrawing nature of benzene ring. Hence, –COOH group cannot transfer H^+ ion to $-NH_2$ group and cannot form zwitter ion.

23. (i) Caring nature and curiosity about scientific aspects of medicines are the values shown by Sameer.

(ii) Insulin governs the metabolism of carbohydrates and helps to maintain blood sugar levels.

(iii) Insulin belongs to peptide hormones.

(iv) Vasopressin is also a peptide hormone which controls the re-absorption of water in the kidney.

24. **(i)** In addition polymerisation, the molecules of the same or different monomers add together to form a large polymer molecule without the elimination of simple molecules like H_2O, HCl etc. Whereas in condensation polymerisation two or more bifunctional molecules undergo a series of condensation reactions with the elimination of some simple molecules like H_2O, HCl, etc leading to the formation of polymers.

(ii) A polymer which is obtained from only one type of monomer molecules is known as homopolymer *e.g.*, polythene, polyvinyl chloride, etc.

$$\underset{\text{Ethene}}{n CH_2=CH_2} \longrightarrow \underset{\text{Polythene}}{+CH_2-CH_2+_n}$$

A polymer made from more than one type of monomer molecules is referred to as a co-polymer *e.g.*, nylon-6,6, buna-S,buna-N, etc.

$$\underset{\text{1, 3-Butadiene}}{n CH_2=CH-CH=CH_2} + \underset{\text{Styrene}}{n C_6H_5CH=CH_2} \longrightarrow$$

$$+CH_2-CH=CH-CH_2-CH_2-\underset{|}{\overset{C_6H_5}{CH}}+_n$$

(Buna-S)

(iii)

$$\underset{\text{Ethylene glycol}}{n HOH_2C-CH_2OH} + \underset{\text{Terephthalic acid}}{n HOOC-C_6H_4-COOH}$$

$$\xrightarrow[-(2n-1)H_2O]{420-460\ K,\ Zn(OCOCH_3)_2 + Sb_2O_3} \underset{\text{Terylene (Dacron)}}{+OCH_2CH_2O-C(=O)-C_6H_4-C(=O)+_n}$$

OR

(i) Polythene, polyvinyl and polystyrene soften on heating and harden on cooling. Such polymers are called thermoplastic polymers.

Structural similarity : They possess intermolecular forces intermediate between elastomers and fibres.

(ii)

	Chain Growth Polymerisation	Step Growth Polymerisation
(i)	In this type of polymerisation, the monomers having one or more double bonds undergo repeated addition in presence of an initiator (generally peroxides) to form a chain of polymer.	In this type of polymerisation two different types of monomer units undergo a series of condensation reactions with the elimination of small molecules like water, HCl, NH_3 or alcohol.
	The rate of the reaction is fast and polymer is formed rapidly.	Rate of the reaction is slow and comparatively much more time is required for polymerisation.
	Example : Formation of polythene from ethylene molecules.	Example : Formation of nylon-6,6 from the molecules of hexa-methylenediamine and adipic acid.

25. **(i)** (a) Antifertility drugs : The antibiotic revolution has provided long and healthy life to people. The increased population has caused many social problems in terms of food resources, environmental issues. To control these problems, population is required to be controlled. This has introduced the concept of family planning. Chemical substances which are used to check pregnancy in women are called antifertility drugs. These drugs control the female menstrual cycle and ovulation. Oral contraceptives (which suppress the production of ovum in women) contain progesterone hormone or the chemical having similar structure like progesterone. Norethindrone is an example of synthetic progesterone derivative. The estrogen derivative combined with progesteron derivative is found in ethynylestradiol (novestrol).

(b) Antacids : Over production of acid in the stomach causes irritation and pain. In severe cases, ulcers are developed in the stomach. The substances which neutralise the excess acid and raise the pH to an appropriate level in stomach are called antacids. Antacids contain sodium hydrogencarbonate or a mixture

of magnesium hydroxide and aluminium hydroxide. However, hydrogen carbonate, if taken in excess can make the stomach alkaline and trigger the production of more HCl in stomach. Thus, metal hydroxides are better options because being insoluble, they cannot change the pH beyond 7.

(ii) Chlorine in the concentration 0.2 to 0.4 ppm in aqueous solution acts as disinfectant. So, in order to kill the germs it is added to swimming pools.

OR

(i) A detergent is a surface active agent used for cleaning dirty surfaces. It contains a non polar hydrocarbon chain (hydrophobic part) and polar group (hydrophilic part) within the molecule. On the basis of charge on polar part, detergents are classified as follows:

(a) Anionic detergents in which large part of the molecule is anion and it is the anionic part of the molecule which is involved in their cleansing action. *e.g.*, alkylbenzenesulphonate.

(b) Cationic detergents in which major part of the molecule is cation and it is the cationic part of the molecule which is involved in their cleansing action. These are mostly acetates or chlorides of quaternary amines *e.g.*, Cetyltrimethylammonium chloride.

(c) Non-ionic detergents are esters of high molecular mass formed by reaction between polyethylene glycol and stearic acid.

Detergents are preferred over soaps as they work even in hard water and acidic water They have powerful cleansing action.

(ii) Disinfectants are chemical substances which kill microorganisms but are harmful to human tissues *e.g.*, chlorine acts as a disinfectant when added to swimming pool by killing germs.

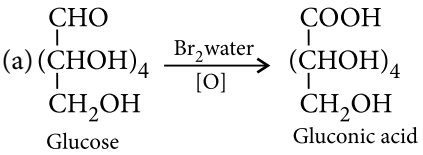
Antiseptics are chemical substances which prevent the growth of microorganisms or even kill them but are not harmful to living tissues *e.g.*, furacin and soframycin.

26. (i) Nucleic acids : Every generation of each species resembles its ancestors in many ways. The nucleus of a living cell is responsible for this transmission of inherent characters, also called heredity. The particles in nucleus of the cell, responsible for heredity are called chromosomes which are made up of protein and another type of biomolecules called nucleic acids. Nucleic acids are biopolymers (*i.e.*, polymers present in the living system). They are also called polynucleotides since the repeating structural unit (monomeric unit) of nucleic acid is a nucleotide. Each nucleotide in made up of three parts, *i.e.*, a sugar molecule, a heterocyclic nitrogenous base and phosphoric acid.

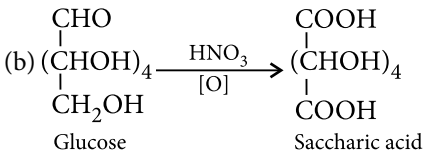
Two important functions of nucleic acids are :

(a) Replication : The process by which a single DNA molecule produces two identical copies of itself is called replication.

(b) Protein synthesis : Another important function of nucleic acid is the protein synthesis in the cell. The proteins are synthesised by various RNA molecules in the cell but the message for the synthesis of a particular protein is present in DNA.

(ii) (a) 

Glucose — Gluconic acid

(b) 

Glucose — Saccharic acid

OR

(i) Characteristic difference between globular and fibrous proteins can be given as :

	Globular Proteins	Fibrous Proteins
1.	These are cross linked proteins and are condensation products of acidic and basic amino acids.	These are linear condensation polymers.
2.	These are usually soluble in water, mineral acids and bases.	These are insoluble in water but soluble in strong acids and bases.
3.	These proteins have three dimensional folded structure. These are stabilised by internal hydrogen bonding *e.g.*, egg albumin and enzymes.	These are linear polymers held together by intermolecular hydrogen bonds and some disulphide bonds *e.g.*, hair and silk.

(ii) (a) Carbohydrates act as biofuels to provide energy for functioning of living organisms.

(b) They act as constituents of cell membrane.

EXAMINER'S MIND CLASS XII

The questions given in this column have been prepared strictly on the basis of NCERT Chemistry for Class XII. This year JEE (Main & Advanced)/AIPMT/AIIMS/other PMTs have drawn their papers heavily from NCERT books.

AMINES | BIOMOLECULES | POLYMERS | CHEMISTRY IN EVERYDAY LIFE

SECTION - I

Only One Option Correct Type

This section contains 20 multiple choice questions. Each question has four choices (a), (b), (c) and (d), out of which ONLY ONE is correct.

1. Identify the product '*C*' in the following series of reactions :

$$\text{Glucose} \xrightarrow{HCN} A \xrightarrow{H_2O} B \xrightarrow{HI} C$$

(a) Heptanoic acid
(b) Hexanoic acid
(c) α-Methyl caproic acid
(d) None of these

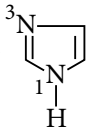
2. Which of the following can possibly be used as an analgesic without causing addiction?
(a) Morphine
(b) *N*-acetyl-*para*-aminophenol
(c) Diazepam
(d) None of these

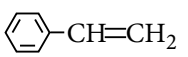
3. Choose the incorrect comparison.

(a) $H_3C-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-NH_2 < CH_3-NHCH_3$ (basicity in the aqueous medium)

(b) $CH_3CH_2CH_2NH_2 > (CH_3)_3N$ (basicity in the aqueous medium)

(c) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{CH}}}}-NH_2 < CH_3-NHCH_2CH_3$ (basicity in the gaseous state)

(d) N(1) > N(3) in  (basicity in the aqueous medium)

4. Head-to-tail addition is not preferred in
(a) $CH_2=CHCl$ (b) $CH_2=CHCN$
(c)  (d) $HO\overset{\displaystyle O}{\overset{||}{C}}(CH_2)_4\overset{\displaystyle O}{\overset{||}{C}}OH$

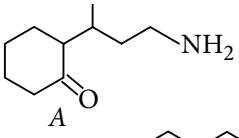
5. An organic compound (*A*) on reduction gives compound (*B*). (*B*) on treatment with $CHCl_3$ and alcoholic KOH gives (*C*). (*C*) on catalytic reduction gives *N*-methylaniline. The compound *A* is
(a) methylamine (b) nitromethane
(c) aniline (d) nitrobenzene.

6. Which of the following is a polymer of three different monomers?
(a) ABS (b) SBR
(c) NBR (d) Nylon-2-nylon-6

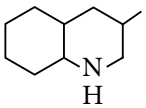
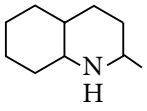
7. An organic compound with the formula $C_6H_{12}O_6$ forms a yellow crystalline solid with phenylhydrazine and gives a mixture of sorbitol and mannitol when reduced with sodium. Which among the following could be the compound?
(a) Fructose (b) Glucose
(c) Mannose (d) Sucrose

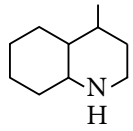
8. The detergent which is used as a germicide is
(a) sodium lauryl sulphate
(b) cetyltrimethylammonium chloride
(c) lauryl alcohol ethoxylate
(d) sodium-2-dodecylbenzenesulphonate.

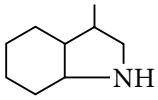
9. Intramolecular reductive amination of compound *A* forms



A

(a)  (b) 

(c) 

(d) 

10. Hydrogen bonding for the base pairs of DNA is between
(a) amide carbonyl and $-NH_2$ only
(b) amide N—H and cyclic amine nitrogen only
(c) alcoholic and carbonyl group only
(d) both (a) and (b).

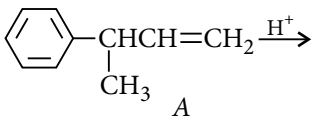
11. Which of the following statements is not true about enzyme inhibitors?
(a) They inhibit the catalytic activity of the enzyme.
(b) They prevent the binding of substrate.
(c) Generally a strong covalent bond is formed between an inhibitor and an enzyme.
(d) Inhibitors can be competitive or non-competitive.

12. Consider the following statements :
I. Cationic-polymerisation occurs in monomers with electron-donating substituents.
II. Anionic-polymerisation occurs in monomers with electron-withdrawing substituents.
III. Head-to-head chain-growth polymerisation occurs in polystyrene.
The correct statements are
(a) I and II (b) I and III
(c) II and III (d) I, II and III

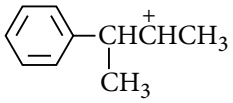
13. A compound '*Z*' reacts with three moles of CH_3I and gives a product which on hydrolysis gives $[(CH_3)_4N]^+OH^-$. Compound '*Z*' is
(a) CH_3NH_2 (b) $(CH_3)_2NH$
(c) $(CH_3)_3N$ (d) $(CH_3)_4\overset{+}{N}I^-$

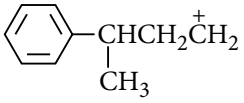
14. Which of the following sets of reactants is used for the preparation of paracetamol from phenol?
(a) HNO_3, H_2/Pd, $(CH_3CO)_2O$
(b) H_2SO_4, H_2/Pd, $(CH_3CO)_2O$
(c) $C_6H_5N_2Cl$, $SnCl_2$/HCl, $(CH_3CO)_2O$
(d) Br_2/H_2O, Zn/HCl, $(CH_3CO)_2O$

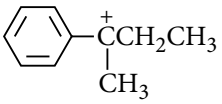
15. Which carbocation is formed most easily when cationic addition polymerisation of compound *A* is initiated by H^+?

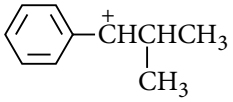


A

(a) 

(b) 

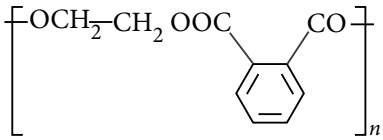
(c) 

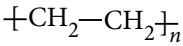
(d) 

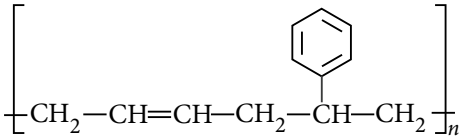
16. Which of the following is not a function of proteins?
(a) Nail formation
(b) Skin formation
(c) Muscle formation
(d) Providing energy for metabolism

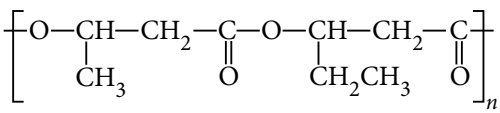
17. Which is the best method of preparing 2° amine?
(a) $CH_3Cl + NH_3 \longrightarrow$
(b) $CH_3Cl \xrightarrow{KCN} \xrightarrow{Sn/HCl}$
(c) $CH_3Cl \xrightarrow{AgCN} \xrightarrow{LiAlH_4}$
(d) $CH_3NH_2 \xrightarrow[\Delta]{CHCl_3/KOH} \xrightarrow{Sn/HCl}$

18. Which of the following is not an α-amino acid?
(a) Cysteine (b) Proline
(c) Trypsin (d) Serine

19. In which of the following polymers ethylene glycol is one of the monomer units?
(a) 

(b) 

(c) 

(d) 

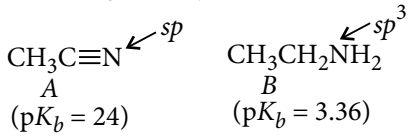
20. Which of the following is not true?
(a) Some disinfectants can be used as antiseptics.
(b) Sulphadiazine is a synthetic antibacterial.
(c) Aspirin is an analgesic as well as an antipyretic medicine.
(d) Polystyrene is used to make non-stick cookwares.

SECTION - II

One or More Options Correct Type

This section contains 5 multiple choice questions. Each question has four choices (a), (b), (c) and (d), out of which ONE or MORE are correct.

21. While comparing basicity of nitriles and amines



we conclude

(a) effect of increased *s*-character on basicity is more pronounced in nitriles as compared to amines

(b) concentrated mineral acid is required to protonate nitriles which are a very weak bases

(c) pyridine with sp^2-hybridised nitrogen would be more basic than CH_3CN

(d) piperidine with sp^3-hybridised nitrogen would be expected to be as basic as $CH_3CH_2NH_2$.

22. Which of the following statements are correct about barbiturates?

(a) They are hypnotics or sleep inducing agents.

(b) They are tranquilizers.

(c) They are non-narcotic analgesics.

(d) They reduce pain without disturbing the nervous system.

23. Which type(s) of interactions are directly involved in maintaining tertiary structure?

(a) Disulphide bridge

(b) Hydrogen bonding

(c) Peptide bonds

(d) Hydrophobic interactions

24. Among the following, chain transfer reagent(s) are

(a) carbon tetrachloride

(b) benzoyl peroxide

(c) benzoquinone

(d) carbon tetrabromide.

25. Which of the following statement(s) about basic character of amines in aqueous medium is/are correct?

(a) Ammonia is more basic than methylamine.

(b) Methylamine is more basic than ammonia.

(c) Dimethylamine is less basic than methylamine.

(d) Dimethylamine is less basic than trimethylamine.

SECTION - III

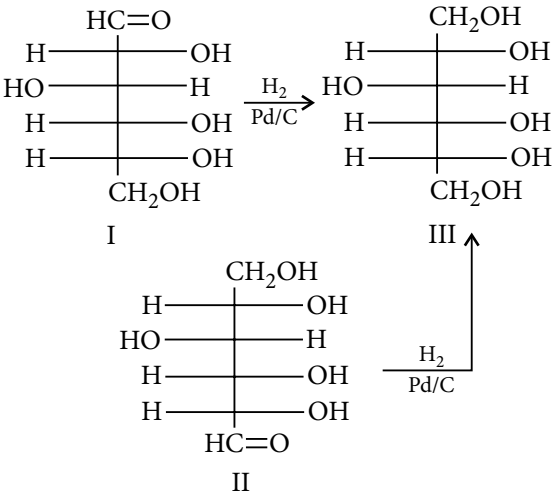
Paragraph Type

This section contains 2 paragraphs each describing theory, experiment, data, etc. Six questions relate to two paragraphs with three questions on each paragraph. Each question of a paragraph has only one correct answer among the four choices (a), (b), (c) and (d).

Paragraph for Questions 26 to 28

Glucose is correctly named as *D*(+)-glucose. '*D*' before the name of glucose represents the configuration whereas '(+)' represents dextrorotatory nature of the molecule. It may be remembered that '*D*' and '*L*' have no relation with the optical activity of the compound.

26. Consider the following transformations and select the correct statement.



(a) In the conversion of I to III or II to III, *D* or *L* configuration is retained.

(b) In the conversion of I to III, *D* or *L* configuration is retained but II to III configuration changes from *D* to *L*

(c) In the conversion of I to III, *D* or *L* configuration is retained but II to III configuration changes from *L* to *D*

(d) In the conversion of I to III, configuration changes from *D* to *L* and in II to III, changes from *L* to *D*.

27. α-*D*-glucose and β-*D*-glucose have a specific rotation of +112° and +19° respectively. In aqueous solution the rotation becomes +52°. This is known as

(a) racemisation (b) mutarotation

(c) inversion (d) enolisation.

28. The optical rotation of the α-form of a pyranose is +150.7° and that of the β-form is +52.8°. In solution, an equilibrium mixture of the anomers has an optical rotation of +80.2°. The percentage of the α-form at equilibrium is

(a) 29% (b) 32%
(c) 68% (d) 72%

Paragraph for Questions 29 to 31

Aliphatic and aromatic primary and secondary amines react with acid chlorides, anhydrides and esters by nucleophilic substitution reaction. This reaction is known as acylation. You can consider this reaction as the replacement of hydrogen atom of $-NH_2$ or > N–H group by the acyl group. The products obtained by acylation reaction are known as amides.

29. Identify the product *Z* in the following reaction scheme :

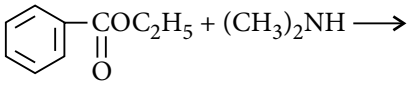
$$C_6H_5NH_2 \xrightarrow{Ac_2O} X \xrightarrow{Br_2/CCl_4} Y \xrightarrow{HOH} Z$$

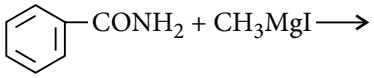
(a) *p*-Bromoaniline
(b) *p*-Bromoacetophenone
(c) *p*-Bromoacetanilide
(d) *o*-Bromoacetophenone

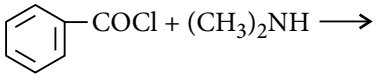
30. The amine that does not react with acetyl chloride is

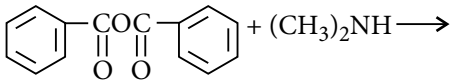
(a) CH_3NH_2 (b) $(CH_3)_2NH$
(c) $(CH_3)_3N$ (d) none of these.

31. Which of the following reactions will not give *N*, *N*-dimethylbenzamide?

(a) 

(b) 

(c) 

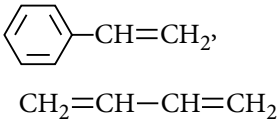
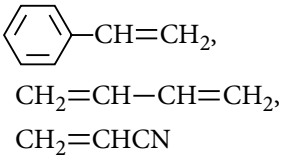
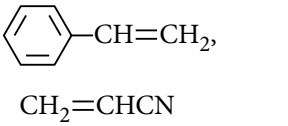
(d) 

SECTION - IV

Matching List Type

This section contains 3 multiple choice questions. Each question has matching lists. The codes for the lists have choices (a), (b), (c) and (d), out of which ONLY ONE is correct.

32. Match the copolymers given in List I with their monomers in List II and select the correct answer using the code given below the lists :

	List I	List II
P.	Saran	1. 
Q.	San	2. 
R.	ABS	3. $CH_2=CHCl$, $CH_2=CCl_2$
S.	SBR	4. 

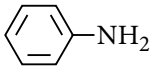
	P	Q	R	S
(a)	1	2	3	4
(b)	3	4	2	1
(c)	2	1	4	3
(d)	3	4	1	2

33. Match the enzymes given in List I with the reactions they catalyse given in List II and select the correct answer using the code given below the lists :

	List I	List II
P.	Invertase	1. Decomposition of urea into NH_3 and CO_2
Q.	Maltase	2. Hydrolysis of maltose into glucose
R.	Pepsin	3. Hydrolysis of cane sugar
S.	Urease	4. Hydrolysis of proteins into peptides

	P	Q	R	S
(a)	1	2	3	4
(b)	3	2	4	1
(c)	2	4	3	1
(d)	1	2	4	3

34. Match the amines given in List I with the reactions they undergo given in List II and select the correct answer using the code given below the lists :

	List I	List II
P.		1. Cope elimination
Q.	CH_3NH_2	2. Azo dye formation
R.	$(CH_3)_2NH$	3. Carbylamine reaction
S.	$(CH_3CH_2)_3N$	4. Yellow oily liquid with HNO_2

	P	Q	R	S
(a)	1	4	2	3
(b)	2	3	1	4
(c)	4	1	3	2
(d)	2	3	4	1

SECTION - V

Assertion Reason Type

In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as :

(a) If both assertion and reason are true and reason is the correct explanation of assertion.
(b) If both assertion and reason are true but reason is not the correct explanation of assertion.
(c) If assertion is true but reason is false.
(d) If both assertion and reason are false.

35. **Assertion :** Chloramphenicol is a bacteriostatic antibiotic.
Reason : It kills the organism in the body.

36. **Assertion :** Vinylidene chloride forms isotactic, syndiotactic and atactic polymers.
Reason : Vinylidene chloride contains chiral carbon atoms.

37. **Assertion :** Glucose and fructose give the same osazone.
Reason : Glucose and fructose have same stereochemistry at C_3, C_4 and C_5.

38. **Assertion :** Controlled nitration of aniline at low temperature mainly gives *m*-nitroaniline.
Reason : In acidic medium, NH_2 group gets converted into $-\overset{+}{N}H_3$ group which is *m*-directing.

39. **Assertion :** Penicillin-G is an antibiotic.
Reason : Penicillin-G is effective against gram positive as well as gram negative bacteria.

40. **Assertion :** Olefinic monomers undergo addition polymerisation.
Reason : Polymerisation of vinyl chloride is initiated by peroxides/persulphates.

SECTION - VI

Integer Value Correct Type

This section contains 10 questions. The answer to each question is a single digit integer, ranging from 0 to 9 (both inclusive).

41. The number of optically active 1° amines of the formula $C_5H_{13}N$ is

42. The number of disulphide linkages present in insulin is

43. The functionality of adipic acid is

44. Percentage of sulphur used in the vulcanisation of rubber which is used in tyres is

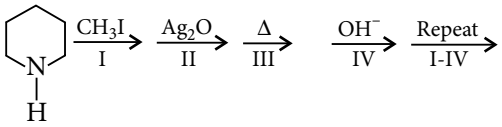
45. The number of polymers that are biodegradable in nature in the given list is
Cellulose, PVC, polystyrene, glyptal, dextron, PHBV, nylon-2-nylon-6, nylon-6,6, PAN.

46. For natural polymers PDI generally is

47. In the primary structure of nucleic acid, bases are present at x^{th} carbon atom of pentose sugar. The value of x is

48. x percent solution of phenol acts as a disinfectant. x is

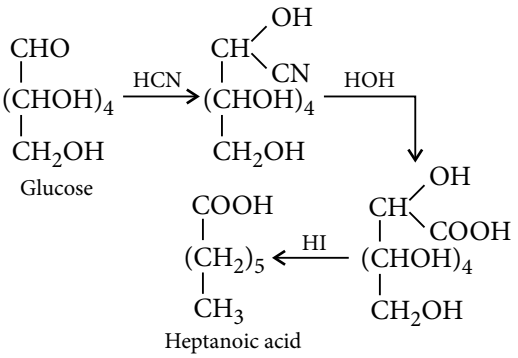
49. Number of π electrons present in the product of following exhaustive methylation is



50. A tripeptide is composed equally of L-valine, L-tyrosine and L-alanine (one molecule of each). Number of isomeric tripeptides of this kind that may exist is

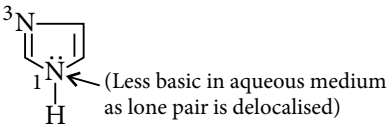
SOLUTIONS

1. (a) :



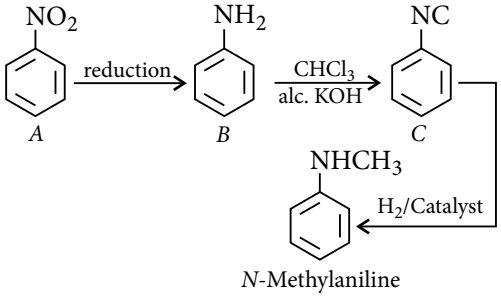
2. (b)

3. (d) :

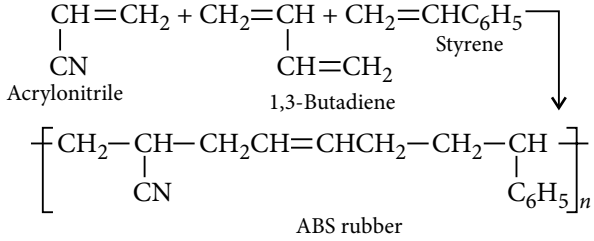


4. (d)

5. (d):



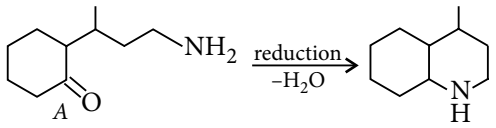
6. (a) : ABS is acrylonitrile-butadiene-styrene rubber which is obtained by copolymerisation of acrylonitrile, 1, 3-butadiene and styrene.



7. (a) : Since the compound forms a yellow crystalline solid, *i.e.*, osazone wih phenylhydrazine, it may be an aldohexose or a ketohexose. Further since on reduction, compound forms a mixture of sorbitol and mannitol, it must be a ketohexose, *i.e.*, fructose. Glucose on reduction gives only one alcohol glucitol (sorbitol).

8. (b)

9. (c) :

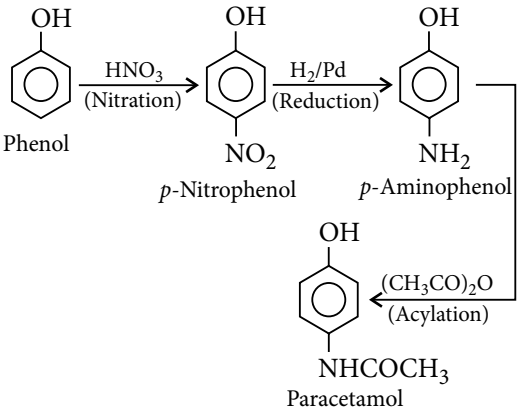


10. (d)

11. (c) : Inhibitors are chemical substances which tend to reduce the activity of a particular enzyme. Generally a weak bond such as hydrogen bonding, van der Waals interaction etc. is formed between the enzyme and the inhibitor.

12. (a) **13. (a)**

14. (a) :



15. (c)

16. (d) : Proteins do not provide energy for metabolism.

17. (d):

(a) $CH_3Cl \xrightarrow{NH_3} CH_3NH_2 \xrightarrow{CH_3Cl} (CH_3)_2NH \xrightarrow{CH_3Cl} (CH_3)_3N \xrightarrow{CH_3Cl} (CH_3)_4N^+Cl^-$

(mixture is formed)

(b) $CH_3Cl \xrightarrow{KCN} CH_3CN \xrightarrow{Sn/HCl} CH_3CH_2NH_2$

1° amine

(c) $CH_3Cl \xrightarrow{AgCN} CH_3NC \xrightarrow{LiAlH_4} CH_3NHCH_3$

2° amine

$+$

$CH_3CN \xrightarrow{LiAlH_4} CH_3CH_2NH_2$

1° amine

(some 1° amine is also formed)

(d) $CH_3NH_2 \xrightarrow[\Delta]{CHCl_3/KOH} CH_3NC \xrightarrow{Sn/HCl} CH_3NHCH_3$

2° amine (pure)

18. (c)

19. (a) : The polymer is glyptal and its monomers are ethylene glycol ($CH_2OH - CH_2OH$) and phthalic acid ($HOOC - C_6H_4 - COOH$).

20. (d)

21. (a, b, c)

22. (a, b): Barbiturates are tranquilizers which are used as used as hypnotics or sleep inducing agents.

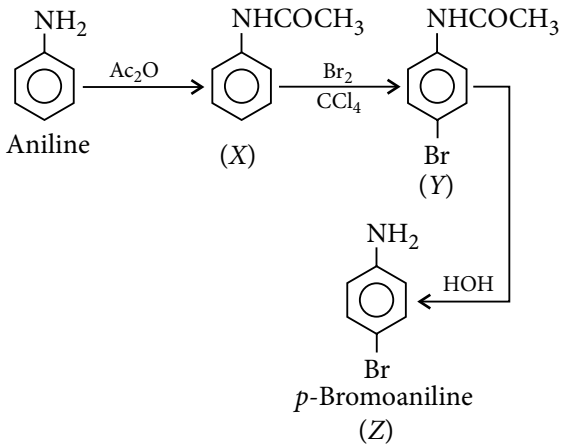
23. (a, b, d)

24. (a, d) : Carbon tetrachloride and carbon tetrabromide act as chain transfer reagents in vinyl polymerisation.

25. (b) : Basic character of amines in aqueous medium is $2° > 1° > 3° > NH_3$.

26. (c) **27. (b)** **28. (a)**

29. (a) :



30. (c) : The compounds containing active H-atoms (H atoms attached to N, O or S) react with CH_3COCl to form acetyl derivatives.

31. (b) : (a) $C_6H_5COOC_2H_5 + (CH_3)_2NH \longrightarrow C_6H_5CON(CH_3)_2 + C_2H_5OH$

(b) $C_6H_5CONH_2 + CH_3MgI \longrightarrow C_6H_5CONHMgI + CH_4$

(c) $C_6H_5COCl + (CH_3)_2NH \longrightarrow C_6H_5CON(CH_3)_2 + HCl$

(d) $C_6H_5\overset{O}{\overset{\|}{C}}O\overset{O}{\overset{\|}{C}}C_6H_5 + (CH_3)_2NH \longrightarrow C_6H_5CON(CH_3)_2 + C_6H_5COOH$

32. (b) **33. (b)** **34. (d)**

35. (c) : It inhibits the growth of the organism.

36. (d)

37. (a) : Glucose and fructose have the same stereochemistry at C_3, C_4 and C_5 chiral carbon atoms, hence form same osazone.

38. (a)

39. (c) : Penicillin-G is a narrow spectrum antibiotic and has bactericidal effect.

40. (b) : Due to the presence of double bonds, a large number of olefin molecules simply add to form a high molecular mass molecule.

41. (2)

42. (3) : Insulin is composed of two peptide chains referred as the chain *A* and *B*. Chain *A* of 21 residues and chain *B* of 30 residues are crosslinked by two disulphide bridges. Also, the smaller polypeptide chain has an internal disulphide linkage.

43. (2) : Functionality of a monomer means the number of bonding sites present in it *e.g.*, functionality of ethene, propene, styrene, acrylonitrile is one and that of ethylene glycol, adipic acid, hexamethylene diamine is two.

44. (5) : 5% of sulphur is used in vulcanisation of rubber used for making tyres.

45. (4) : Cellulose, PHBV, nylon-2-nylon-6 and dextron are biodegradable polymers.

46. (1) : Polydispersity index (PDI) $= \dfrac{\overline{M}_w}{\overline{M}_n}$

For natural polymers, PDI = 1

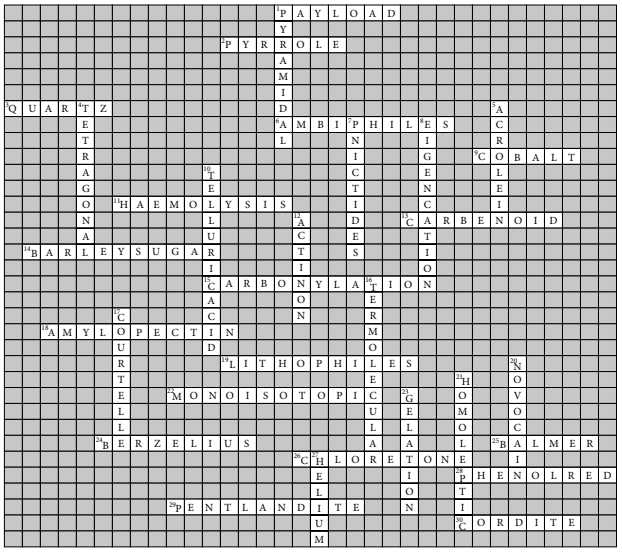
$\therefore \quad \overline{M}_w = \overline{M}_n$

47. (1) **48. (1)**

49. (4) : 1,3-Butadiene is formed.

50. (6) : Val. Tyr. Ala Tyr. Ala. Val
Val. Ala. Tyr Ala. Tyr. Val
Tyr. Val. Ala Ala. Val. Tyr

SOLUTIONS TO DECEMBER 2015 CROSSWORD



Winners of December 2015 Crossword

- Rama Bajaj (Delhi)
- Nitesh Tiwari (Kanpur)
- Savita Desai (Dehradun)

CONCEPT BOOSTER

Dear students!! After the festive season, it is the time to get back to the work as now it is going to be the exam season. In exam, problem solving approach plays a big role. This article is going to help you for the same.
Wish you all a very happy new year. All the very best!!

*Arunava Sarkar

BIOMOLECULES

SINGLE OPTION CORRECT TYPE

1. Glucose reacts with acetic anhydride to form
(a) monoacetate (b) tetraacetate
(c) pentaacetate (d) hexaacetate.

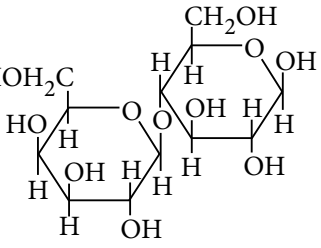
2. The number of chiral carbons in β-D(+)-glucose is
(a) five (b) six
(c) three (d) four.

3. Glucose reacts with excess of phenylhydrazine and forms
(a) glucosazone
(b) glucose phenylhydrazone
(c) glucose oxime
(d) sorbitol.

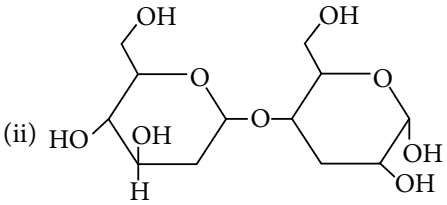
4. α-glucose and β-glucose differ in the orientation of – OH group around
(a) C_1 (b) C_2
(c) C_3 (d) C_4

5. Out of the following structures, which are reducing sugars?

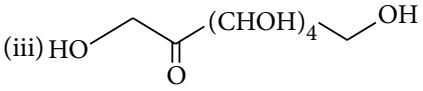
(i)



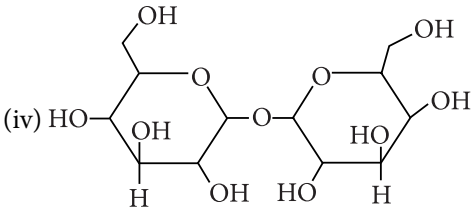
(ii)



(iii)



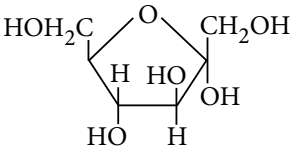
(iv)



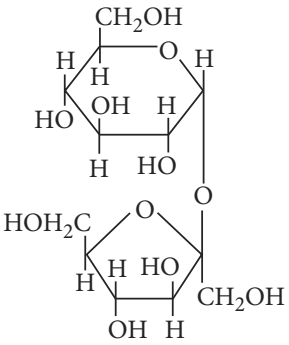
(a) (i), (ii) (b) (ii), (iii)
(c) (i), (ii) and (iii) (d) All of these

6. Which of the following sugars will react with Ag^+?

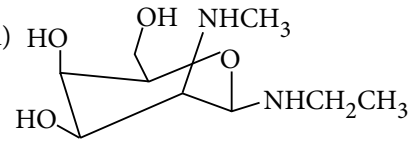
(i)

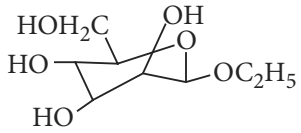


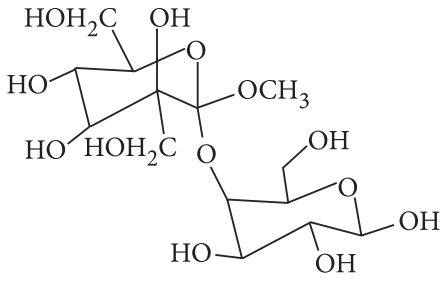
(ii)

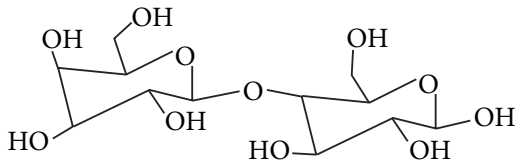


* Institute of Chemistry (IOC)- Asansol, Durgapur, Dhanbad, Burdwan, Kolkata, Jamshedpur, Bokaro, Patna

(iii) 

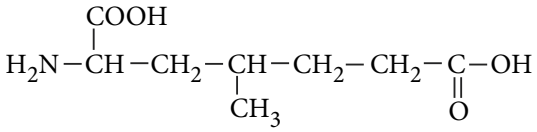
(iv) 

(v) 

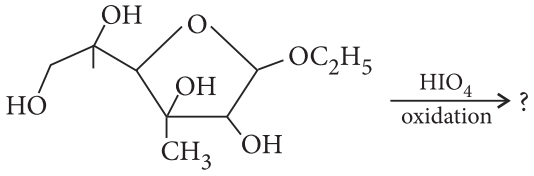
(vi) 

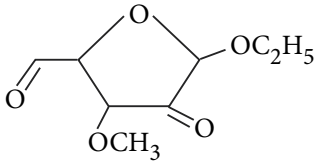
(a) (i), (ii) and (iii) (b) (ii), (v) and (vi)
(c) (iii), (v) and (vi) (d) (i), (v) and (vi)

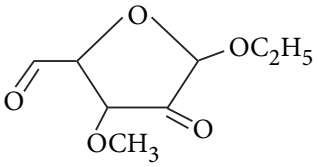
7. What will be the net charge of the following species at pH = 14?

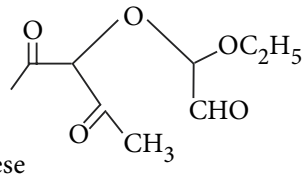


(a) +1 (b) +2
(c) −1 (d) −2

8. 

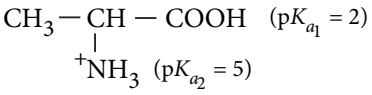
(a) HCHO + 

(b) HCOOH + 

(c) HCHO + 

(d) None of these

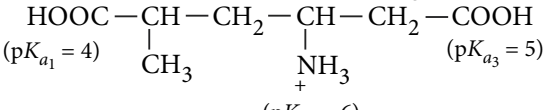
9. Find out the isoelectric point of the following amino acid.



(a) 3.8 (b) 4.2
(c) 2.8 (d) None of these

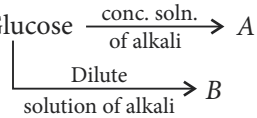
10. For an amino acid, isoelectric point is 5.8. At what pH, maximum concentration of zwitter ion is found?
(a) pH > 5.8 (b) pH < 5.8
(c) pH = 5.8 (d) pH = 2 × 5.8

11. Find isoelectric point of the following amino acid :



(a) 4.5 (b) 5 (c) 6 (d) 4

12. How can you differentiate between D-glucose and D-fructose?
(a) Using Brady's reagent
(b) Using Tollen's reagent
(c) Using $Br_2 + H_2O$ (d) None of these

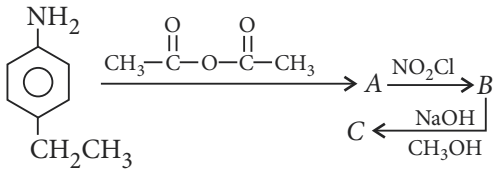
13. 

(a) *A* and *B* are same product.
(b) *A* and *B* are different products.
(c) No reaction in case of *B* (*i.e.*, dilute solution).
(d) No reaction in case of *A* (*i.e.*, conc. solution).

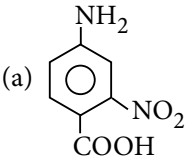
EXAM DATES 2016

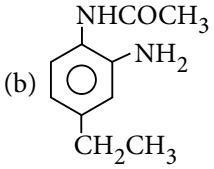
JEE Main	:	3rd April (offline), 9th & 10th April (online)
VITEEE	:	6th to 17th April
MGIMS	:	17th April
Kerala PET	:	25th & 26th April
Kerala PMT	:	27th & 28th April
AIPMT	:	1st May
WBJEE	:	17th May
JEE Advanced	:	22nd May
AIIMS	:	29th May

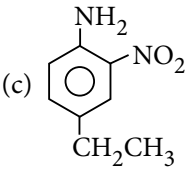
ORGANIC COMPOUNDS CONTAINING NITROGEN

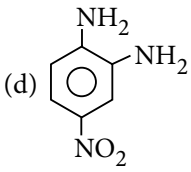
14. 

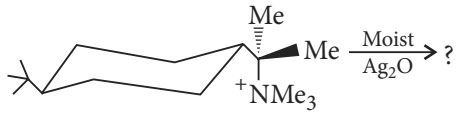
Identify *C* in the above sequence of reactions.

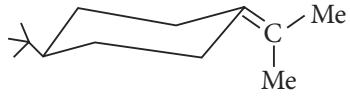
(a) 

(b) 

(c) 

(d) 

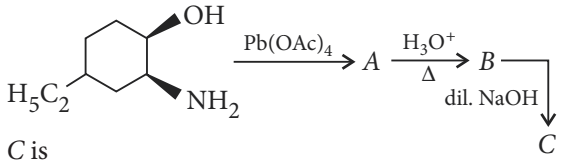
15. 

(a) 

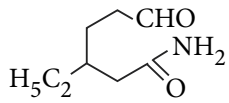
(b) 

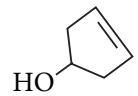
(c) 

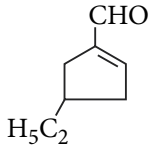
(d) None of these

16. 

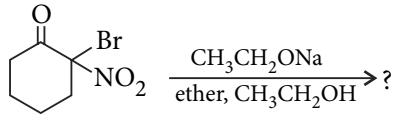
C is

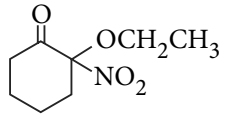
(a) 

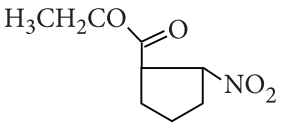
(b) 

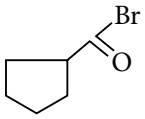
(c) 

(d) None of these.

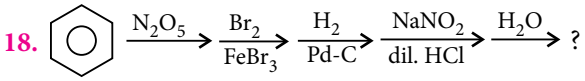
17. 

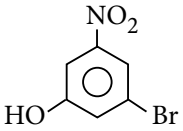
(a) 

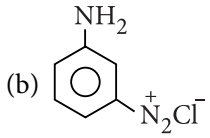
(b) 

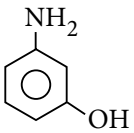
(c) 

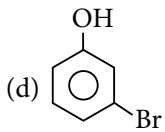
(d) None of these

18. 

(a) 

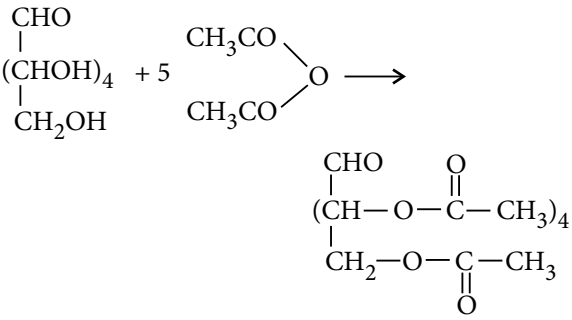
(b) 

(c) 

(d) 

SOLUTIONS

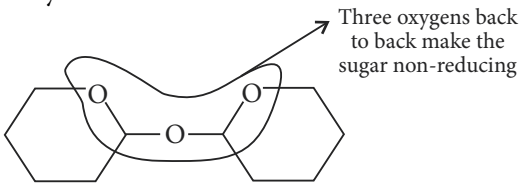
1. (c) : Glucose has five –OH groups. Glucose on reaction with 5 molecules of acetic anhydride gives glucose pentaacetate.



2. (a) **3.** (a) **4.** (a)

5. (c) : Get the trick first.

(I) For a disaccharide, if the skeleton is as below, it will never be reducing as reducing centres are destroyed here :



If other factors are fine, then this trick will work always.

(II) Try to checkout whether –CHO can be found in open chain format or not. Try to think whether

mild oxidation or hydrolysis can generate – CHO in open chain. This trick will even be useful if there is a question like, "which of the following sugars will react (or will not react) with $AgNO_3$ or Ag^+"?

So, using the above two tricks, correct option is (c) - (i), (ii) and (iii).

(iv) cannot be a reducing sugar.

(iii) is a reducing sugar because there is a fair chance of formation of – CHO group through the oxidation of – CH_2OH group. Moreover, ample keto groups are present in it. (—CHOH also gives —C— on oxidation).

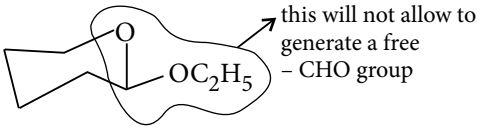
6. (d): Analysis of each structure will help in understanding the complete concept.

(i) : It is α-D-fructofuranose. It is a ketose. It is of course reducing and hence will reduce Tollen's reagent *i.e.*, will react with Ag^+.

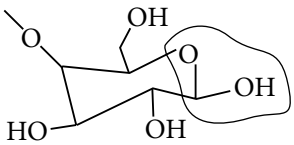
(ii) : It is Haworth projection of sucrose and sucrose is non-reducing in nature. So, it will not react with Ag^+.

(iii) : If the molecule is hydrolysed, it will not give a free – CHO group. Rather, it would give — C — NH — type group. So, it will not react with Ag^+.

(iv) : Here also free —CHO group is not formed

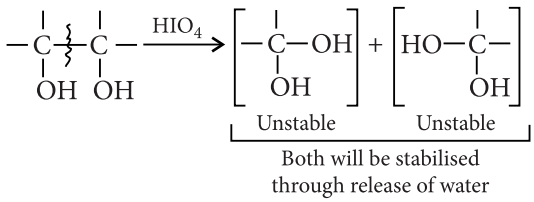


(v) and (vi) : At the lower right corner end, a free —CHO will be available after hydrolysis. It will react with Ag^+.

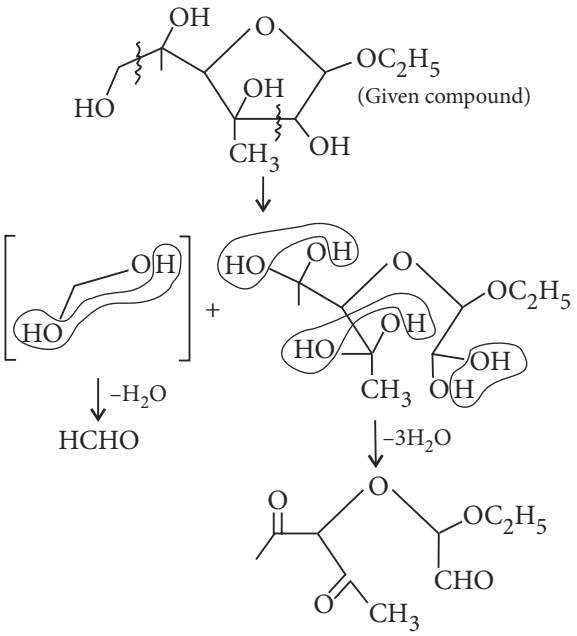


7. (d): At pH = 14, the medium is completely basic or alkaline. So, no change for $—NH_2$ group and —COOH group will remain in the form of $—COO^-$ (carboxylate ion). As there are two —COOH groups, hence two $—COO^-$ will be present. So, net charge will be –2.

8. (c) : The function of HIO_4 is to break down the glycol compounds (two adjacent carbons holding one —OH group each) in the following manner.



Hence, the oxidation of given compound can be represented as :



9. (d): Isoelectric point $= \frac{pK_{a_1} + pK_{a_2}}{2} = \frac{2+5}{2} = 3.5$

10. (c) : It is the pH at isoelectric point at which the maximum concentration of zwitter ion is found.

11. (a) : The trick is $—NH_2$ group is present in the $\overset{+}{N}H_3$ form. So, no considerable contribution from this group (in acidic medium specially).

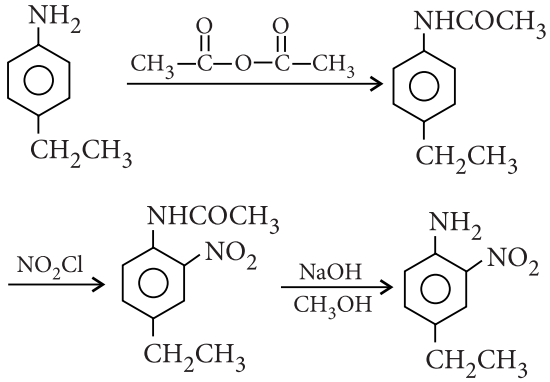
$\therefore$ Isoelectric point is $\frac{4+5}{2} = 4.5$

12. (c) : D-glucose on reaction with Br_2/H_2O, gives D-gluconic acid but D-fructose doesn't give. Hence, correct option is (c), $Br_2 + H_2O$.

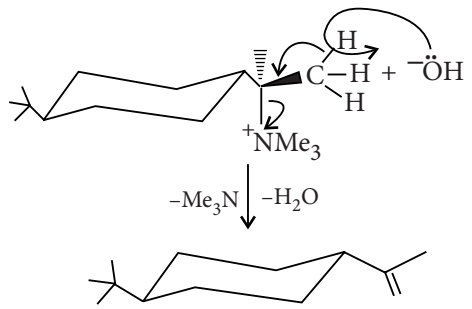
13. (b)

14. (c) : In presence of acetic anhydride, $—NH_2$ group is prone to be converted to $—NHCOCH_3$. NO_2Cl has polarisation as $\overset{\delta+}{N}O_2\overset{\delta-}{Cl}$. So, $\overset{+}{N}O_2$ will attack the ring activated by both $—NHCOCH_3$ and $—C_2H_5$

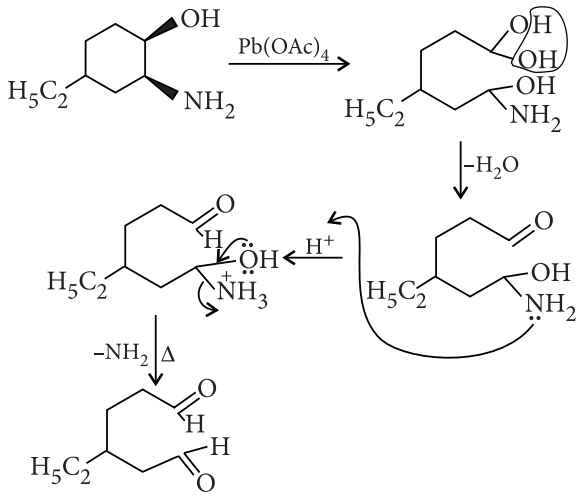
groups but directive influence will be controlled by —$NHCOCH_3$ which is more powerful. *Para* position is blocked so, substitution will surely be at the *ortho* position. NaOH/CH_3OH will convert —$NHCOCH_3$ back to —NH_2 as if hydrolysis is taking place.



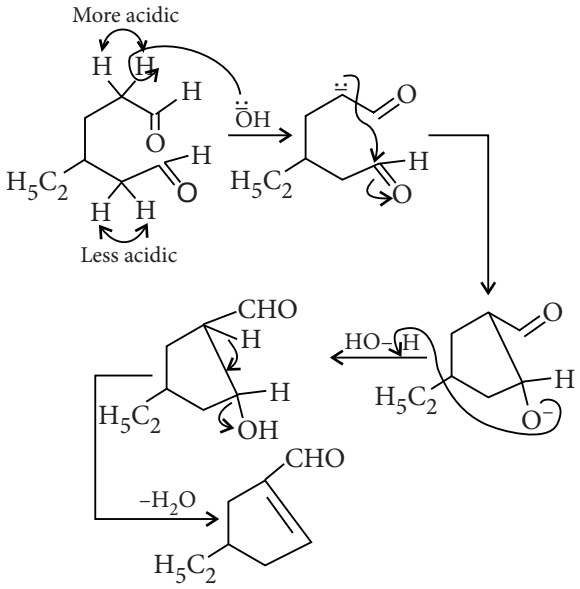
15. (b): It is mere a case of Hoffmann's elimination. Moist Ag_2O ($Ag_2O + H_2O \rightarrow 2AgOH$) will give $^{-}\ddot{O}H$ which will abstract proton from the less hindered site. Therefore, the reaction can be written as :



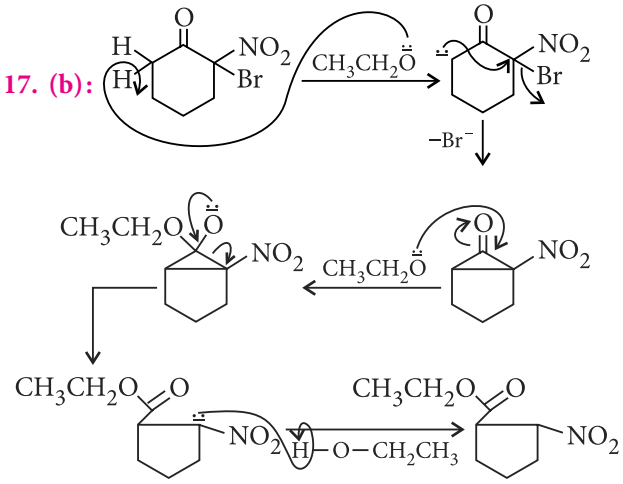
16. (c) : $Pb(OAc)_4$ gives Criegee reaction which occur in following two steps :



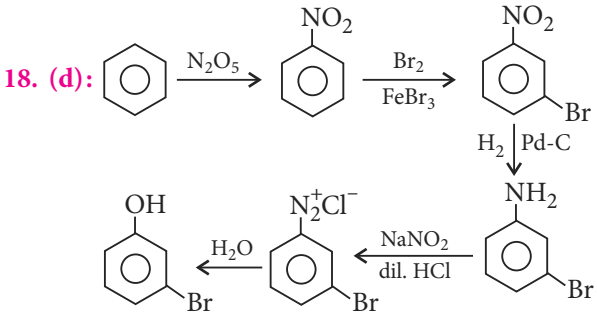
Now, in presence of dilute alkali, the product will undergo internal aldol condensation reaction :



17. (b):



18. (d):



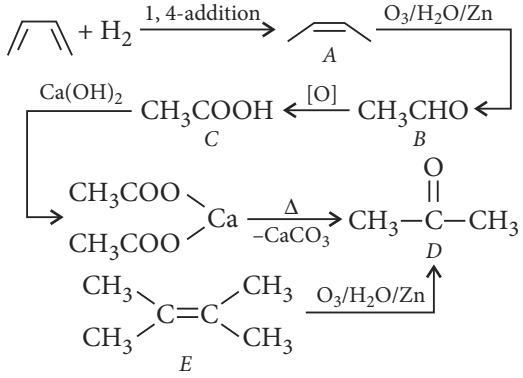
—NO_2 is *meta* directing. Hence, —Br will be inserted at the *meta* position.

CHEMISTRY MUSING

SOLUTION SET 29

1. (c)

2. (a) :



3. (d) : $MnO_2 + 4HCl \longrightarrow MnCl_2 + 2H_2O + Cl_2\uparrow$

$Pb_3O_4 + 8HCl \longrightarrow 3PbCl_2 + 4H_2O + Cl_2\uparrow$

$2KMnO_4 + 16HCl \longrightarrow 2KCl + 2MnCl_2 + 8H_2O + 5Cl_2\uparrow$

$CaOCl_2 + 2HCl \longrightarrow CaCl_2 + H_2O + Cl_2\uparrow$

4. (b) : Let V = Volume of NaOH (in mL) required to reach the equivalence point.

Since the salt formed at equivalence point will be of weak acid and strong base, the pH must be more than 7. On addition of 40 mL NaOH, pH is 5 so, more volume of NaOH should be added to reach equilibrium point so as to make pH > 7. Thus, V should be greater than 40 mL.

Let M is the molarity of NaOH and MV millimoles of weak acid are taken initially.

$$CH_3COOH + NaOH \longrightarrow$$

Initially	(MV) millimoles	($20\,M$) millimoles	$CH_3COONa + H_2O$	
Finally	($MV - 20\,M$) millimoles		($20\,M$) millimoles	($20\,M$) millimoles

For the above buffer solution,

$$pH = pK_a + \log_{10}\left(\frac{20\,M}{MV - 20\,M}\right)$$

$$4 = pK_a + \log_{10}\left(\frac{20}{V - 20}\right) \quad ...(1)$$

Similarly, $5 = pK_a + \log_{10}\left(\frac{40}{V - 40}\right)$ ...(2)

By subtracting 1 from 2 we get,

$$1 = \log_{10}\left(\frac{40}{V - 40}\right) \times \left(\frac{V - 20}{20}\right)$$

$$\log_{10} 10 = \log_{10}\left(2 \cdot \frac{V - 20}{V - 40}\right) \Rightarrow 2\left(\frac{V - 20}{V - 40}\right) = 10$$

$V - 20 = 5V - 200 \Rightarrow 4V = 180$

$V = 45$ mL

5. (b) : $(NH_4)_2C_2O_4 + NaOH \xrightarrow{\Delta} NH_3 \xrightarrow{HCl} NH_4Cl$

(A) Colourless salt — White fumes ((B))

$(A) \xrightarrow{CaCl_2} CaC_2O_4$ ((C) White ppt.) $\longrightarrow$ Decolourises acidified $KMnO_4$

6. (a) : I is saccharin, II is bithional (an antiseptic) III is cyclamate and IV is aspartame.

7. (b) : $2CH_3COONa_{(aq.)} \xrightarrow{\text{Electrolysis}} C_2H_6 + 2CO_2 + 2NaOH + H_2$

$2CH_3COO^- \longrightarrow C_2H_6 + 2CO_2 + 2e^-$

$2H^+ \longrightarrow H_2 + 2e^-$

According to Faraday's first law,

$$\frac{W}{E} = \frac{I.t}{96500} = \frac{0.965 \times 1 \times 60 \times 60}{96500} = 0.036$$

Thus, total number of equivalents of $C_2H_6 + CO_2 + H_2$ $= 0.036 + 0.036 + 0.036$

$\therefore$ Total moles of gases (n)

$$= \frac{0.036}{2} + \frac{0.036}{1} + \frac{0.036}{2}$$

$$\left[\because E_{C_2H_6} = \frac{M}{2};\ E_{H_2} = \frac{M}{2};\ E_{CO_2} = \frac{M}{1}\right]$$

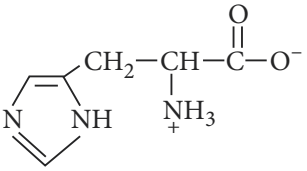
$$\therefore \quad V = \frac{nRT}{P} = \frac{0.072 \times 0.0821 \times 298}{1} = 1.762\ \text{L}$$

8. (d) : Three faradays of electricity will deposit 3 moles of Ag, 1.5 moles of copper, and 1 mole of gold. [$\because$ $Ag^+ + e^- \rightarrow Ag$, $Cu^{2+} + 2e^- \rightarrow Cu$ and $Au^{3+} + 3e^- \rightarrow Au$]

Therefore, the molar ratio is 3 : 1.5 : 1 or 6 : 3 : 2.

9. (9)

10. (1) : At pH = 8, molecule exists as



Solution Senders of Chemistry Musing

SET 29

1. Rishabh Dutta Roy (Jharkhand)
2. AVN Prasad (Guwahati)

SET 28

1. Hiyachaki Saikia (Assam)
2. Devjit Acharjee (West Bengal)
3. CVK Rao (Andhra Pradesh)

YOU ASK WE ANSWER

Do you have a question that you just can't get answered?

Use the vast expertise of our mtg team to get to the bottom of the question. From the serious to the silly, the controversial to the trivial, the team will tackle the questions, easy and tough.

The best questions and their solutions will be printed in this column each month.

Q 1. How does inert pair effect occur?

(Surinder Singh)

Ans. Inert pair effect states that the valence ns^2 electrons of metallic elements particularly $5s^2$ and $6s^2$ pairs which follow the second and third row transition metals, are less reactive than expected on the basis of trends in effective nuclear charge, atomic sizes, and ionisation energies. It can be explained in two different ways :

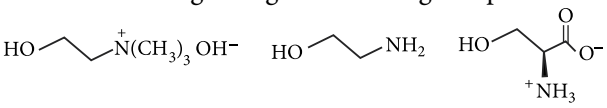
One is the trend in ionisation energies going down a given group. A general decrease is expected due to the increase in atomic size. The expected decrease from boron to aluminium is evident but ionisation energies of gallium and thallium in particular, have higher values than expected. The best explanation is that the 4*s*, 5*s*, and 6*s* electrons of Ga, In, and Tl, respectively are not shielded as effectively from the nucleus by the intervening filled *d*- and *f*- subshells. It simply means that the 4*s*, 5*s* and 6*s* electrons experience a larger effective nuclear charge than expected and consequently they are more difficult to ionise.

The second aspect of the explanation of the inert pair effect is the trends in bond energies on going down a group such as Group 13. A decrease in bond energy is expected on going down the group due to the increase in atomic size and hence the bond distance. Consequently, the bonding electrons in the region of overlap of the valence orbitals of these larger atoms, are farther from the nuclei of the atoms and have less ability to hold the two nuclei together. Thus, the energy released in the formation of bonds is not enough to remove the valence ns^2 electrons.

Q 2. What are phosphatides and how do they resemble soaps and detergents?

(Chandni Malhotra, Amritsar)

Ans. Phosphatides are the compounds formed when the phosphate group of a phosphatidic acid is bound through another phosphate ester linkage to one of the following nitrogen containing compounds :



Choline | **2-Aminoethanol (ethanolamine)** | **L-Serine**

The most important phosphatides are the lecithins, cephalins, phosphatidylserines, and plasmalogens (a phosphatidyl derivative).

Phosphatides resemble soaps and detergents in a way that they are molecules having both polar and non-polar groups. Like soaps and detergents, phosphatides also dissolve in aqueous media by forming micelles. There is evidence that in biological systems the preferred micelles consist of three dimensional arrays of stacked bimolecular micelles that are better described as lipid bilayers.

Q 3. The following expression of equilibrium constant holds good only when all reactants and products behave ideally. What would be the expression when they do not behave ideally?

$$K = \frac{[C]^c\,[D]^d}{[A]^a\,[B]^b}$$

(Keshav Kaushik, Haryana)

Ans. For reactions between gases at high pressures, or for reactions in markedly non-ideal solutions, the concept of activity is used. The activity of a substance may be thought of as an effective concentration. By using activities of substances the equilibrium constant expression for all situations can be written as :

$$\frac{\{C\}^c\,\{D\}^d}{\{A\}^a\,\{B\}^b} = K$$

where, the notation $\{A\}$ stands for the activity of A. Thus in terms of the activity, the equilibrium constant expression has its simple form and is always constant at a particular temperature. For an ideal gas the activity is numerically equal to the pressure in atmospheres, but for a non ideal gas the activity must be calculated from the experimentally determined equation of state.

ADVANCED CHEMISTRY BLOC

(SPECIFIC CONDUCTANCE AND EQUIVALENT CONDUCTANCE)

Mukul C. Ray, Odisha

Variation with Concentration

Specific conductance (generally called as conductivity), molar conductance and equivalent conductance of a solution all vary with concentration. The equivalent conductivity of a solution behaves almost in a similar way with dilution as molar conductance but the magnitude may be different and the unit is surely different.

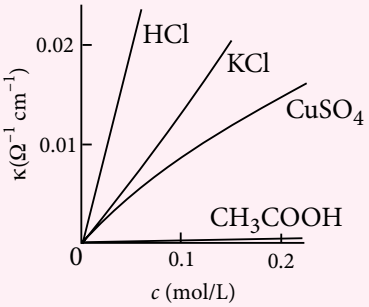
1. Conductivity :

For both strong and weak electrolytes conductivity decreases with dilution or increases with concentration. The expression for conductivity is expressed as

$$\kappa = C \times \frac{l}{a}$$

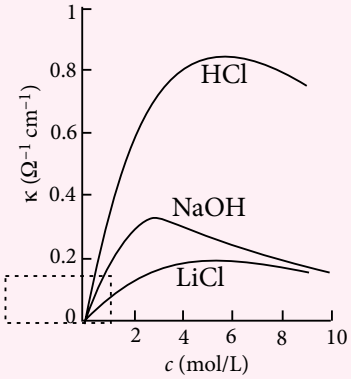
The terms have their usual meanings. The separation between the two electrodes and the area of cross section of the electrodes in the cell constant (l/a) have a fixed value for any conductance cell. When the solution is diluted, the space between the electrodes which always contains a fixed volume of the electrolytic solution now contains less ions and the conductivity of the solution is lowered.

Now, cautiously observe the following graphs :



Variation of conductivity with concentration in low concentration range (I)

The graph (I) is similar to a magnified presentation of the dashed line rectangle on graph (II) but with different reagents. When concentration increases, the number of ions in the space between the electrodes



Variation of conductivity with concentration in high concentration range (II)

increases and conductance increases but after a certain limit, they start forming ion pairs within the medium. Now, the ionic mobility is impaired *i.e.*, reduced. In high concentration range, conductivity decreases with increase in concentration.

2. Molar conductivity :

Molar conductivity of an electrolytic solution is expressed as :

$$\Lambda_m = \frac{1000\kappa}{M}$$

where 'κ' is conductivity in ohm^{-1} cm^{-1} and 'M' is molarity. On increasing dilution, molar conductivity increases both for strong and weak electrolytes. It's a reverse behaviour as compared to conductivity. This is because with increasing dilution 'κ' decreases and 'M' also decreases but 'M' decreases much more rapidly than 'κ'.

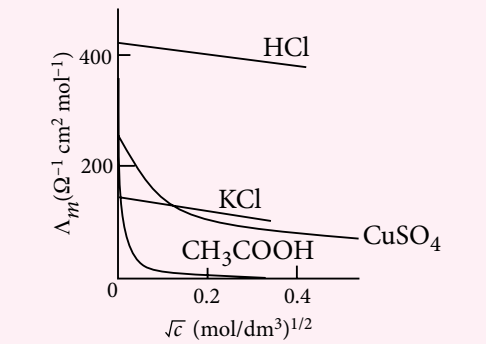
The Debye-Huckel equation for strong electrolytes is the quantitative relation between molar conductance and concentration of solution without involving 'κ' (because 'κ' also depends on concentration).

$$\Lambda_m = \Lambda^\circ + (\text{constant})\sqrt{C}$$

This constant depends on factors like dielectric constant

of the medium, viscosity of the solvent, valencies of ions, temperature, etc. There is no such equation which is applicable for weak electrolytes.

For strong electrolytes, the graph shows an expected linear behaviour.



Variation of molar conductance with concentration

For HCl, the molar conductance is much higher than that for KCl at the same concentration. Each electrolyte furnishes ions in solution but the intrinsic nature of ions may be different. Hydrogen ion is the fastest moving ion in the aqueous solution, followed by hydroxyl ion and then others. Grotthuss mechanism has been put forward to explain this swift migration of hydrogen ion. It says physically a hydrogen ion does not migrate in water rather continual breaking and making of hydrogen bonds make this faster movement possible. So, two strong electrolytes even in fully ionised state may have wide difference in molar conductivities at a fixed concentration. This depends on the number of moles of ions produced by each of them, the valence of the ions and also the ion's inherent ability to move across the medium.

Molar conductance increases with dilution, but ultimately a limiting value is reached where the molar conductance does not rise further with dilution. This is called molar conductance at infinite dilution and it is a constant value for any ion or electrolyte at a constant temperature in a fixed solvent. The same is also true for equivalent conductivity.

To realise the difference between molar and equivalent conductance consider an illustration :

Say molar conductivity of Al^{3+} ions is X ohm^{-1} cm^2 mol^{-1} and that of SO_4^{2-} is Y ohm^{-1} cm^2 mol^{-1} at a particular concentration. The molar conductivity of aluminium sulphate is $(2X + 3Y)$ ohm^{-1} cm^2 mol^{-1} as each mole of aluminium sulphate contains two moles of aluminium ions and three moles of sulphate ions. The equivalent conductivity of aluminium sulphate can be determined either by dividing molar conductivity of aluminium sulphate with its valence factor 6 (2 times valence of aluminium ion) or by adding equivalent conductivity of each individual ion. The concept for this addition is, one equivalent of aluminium sulphate contains one equivalent of aluminium ion and one equivalent of sulphate ion :

$$\frac{\Lambda_m}{6} \text{ or } \frac{\lambda_m(Al^{3+})}{3} + \frac{\lambda_m(SO_4^{2-})}{2}$$

So in either case the answer is :

$$\frac{2X+3Y}{6} \text{ ohm}^{-1} \text{ cm}^2 \text{ gram equivalent}^{-1}.$$

Generally, equivalent conductivity is employed to compare ion's ability to conduct, as ions may be monovalent, bivalent etc. A bivalent ion has more charge and accordingly each mole can show more conductance as compared to monovalent ion. When divided by the valence factor, all the ions are brought to a single platform where a better comparison regarding their built-in ability to conduct can be made. Here are some data to compare :

Ion	Equivalent conductance at 25°C
H^+	349.8
Li^+	38.7
OH^-	198.0
Na^+	50.1
K^+	73.5
Cl^-	76.3
CH_3COO^-	40.9
Ca^{2+}	59.5

Note that the molar conductivity of calcium ion is 119.0 units.

Copper sulphate is a strong electrolyte, but at low dilution or high concentration (rightward of the graph) its molar conductance decreases more rapidly than KCl. This is partly because increased degree of ion pairing for bivalent ions at higher concentration. Acetic acid, is a weak acid and for such electrolytes the Debye Huckel equation is not valid. Its graph is just superimposed to see the difference and can be concluded that its molar conductance though less at the right hand part of the graph, (that is at higher concentration) increases more rapidly as dilution is increased. The qualitative explanation for this increase is that with dilution both degree of ionisation and ionic mobility increase for a weak electrolyte.

Contribution due to Ionic Mobility

The migration of the ions under the influence of the electric field, set up by virtue of the potential difference between the electrodes, is governed by the mobility of the ions. But ionic velocity is altogether a different term. It is not to be confused with ionic mobility. For example, in the solution both $Li^+_{(aq)}$ and $K^+_{(aq)}$ must move at the same speed.

The velocity with which an ion moves under the influence of the applied field is proportional to the applied field.

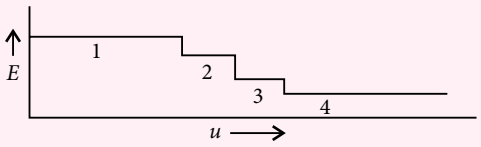
$$v \propto X \quad \text{and} \quad v = uX$$

where, u is the ionic mobility. Now, velocities of ions must be equal consequently, the value of uX is same for both $Li^+_{(aq)}$ and $K^+_{(aq)}$. Hence, the ratio of ionic mobilities for these two ions is a constant and the ratio of fields for these two ions is also a constant.

$$u(Li^+)\, X(Li^+) = u(K^+)\, X(K^+)$$

$$\frac{u(Li^+)}{u(K^+)} = \frac{X(K^+)}{X(Li^+)}$$

The value of the ratio of the fields in the above expression is constant and it certainly has a value less than one as ionic mobility of K^+ is greater than that of Li^+. This concludes that the ratio of the fields under which ion moves is a constant.



The field felt by four ions, extreme left one (marked as 1) has lowest mobility and experiences highest field whereas the most right one has the highest mobility and experiences lowest field to keep velocities of all four same.

The ionic mobility of an ion in an electrolytic solution is really a measure of the maximum velocity of the ion for a given potential field. A high mobility physically represents a high ion velocity for a given potential field and is a function of ionic radii, solution, viscosity, and ion charge number.

This ionic mobility is linked to ionic conductance as :

$$\text{Absolute ionic mobility} = \frac{\text{Ionic conductance}}{96500}$$

VITEEE-2016 B.Tech Engineering Entrance Exam Application forms sales begins

VIT University Chancellor Dr. G. Viswanathan is seen inaugurating the sale of the VITEEE-2016 application forms, to some of the aspiring students for the tests, in April 2016 at the Vellore Head Post Office on Friday. Seen others in the picture are Superintendent of Posts A. Natarajan, Deputy Superintendent R. Mahendran, VIT University's VC Dr. Anand A Samuel, Pro-VC Dr. S. Narayan, VPs Sankar Viswanathan, Sekar Viswanathan and G.V. Selvam, Director UG Admissions, K. Manivannan, PRO- (Posts) Kathir Ahmed and Marketing Executive S. Selvakumar.

The sale of application forms for the VIT University Entrance Examinations (VITEEE-2016) to be held in April 2016, for B.Tech courses various streams, began in all the 92 Head Post Offices, with the VIT University Chancellor **Dr. G. Viswanathan** inaugurating it at the Head Post Office, here, on Friday.

It is scheduled that the entrance examinations for the B.Tech offered in the VIT University, Vellore and Chennai Campuses, will be held from **April 6th to April 17th 2016**. This Computer Based Test (CBT) is held in **118 cities including Dubai, Kuwait and Muscat**.

The University offers courses in Vellore Campus - Bio-Medical Engineering, Biotechnology, Computer Science and Engineering (Specialisation in Bioinformatics), Civil Engineering, Chemical Engineering, Computer Science and Engineering, Electronics and Communication Engineering, Electrical and Electronics Engineering, Electronics and Instrumentation Engineering, Information Technology, Mechanical Engineering, Mechanical Engineering (Specialisation in Automotive Engineering), Mechanical Engineering (Specialisation in Energy Engineering), Production and Industrial Engineering and in **Chennai Campus** – B.Tech in Civil Engineering, Computer Science and Engineering, Electronics and Communication Engineering, Electrical and Electronics Engineering and Mechanical Engineering.

The entrance examination application forms from the Head Post Offices, it can be obtained by sending a Demand Draft for **Rs.990/-** drawn in favour of VIT University, payable at Vellore to the Director – UG Admissions or by cash payment at selected post offices across the country. Issuing of online and offline application has commenced from **November 27th 2015**.

Candidates can also apply online at **www.vit.ac.in** (online applicants need to pay **Rs.960/-** only). The last date for applying is **29th February, 2016**.

VIT University has been consistently been ranked among the premier engineering institutions of the country by India Today. VIT has an impressive track record of placement. For the 8th year in a row, VIT has achieved the top slot in placements.

Visit: **www.vit.ac.in** for further details.

At a Glance CHEMISTRY today 2015

MONTHS	Solved Papers (2015)	Practice Papers (2015 & 2016)	Examiner's Mind	JEE Foundation Series/ JEE Accelerated Learning Series	Concept Map	Others
JANUARY	—	CBSE Board Chapterwise Series -8 (2015)	Full Length (Class- XI and XII)	Unit-7 : Organic Compounds Containing Oxygen, Organic Compounds Containing Nitrogen	Thermodynamics	Chemistry Musing Problem Set-18, You Asked, We Answered, Concept Booster, Advanced Chemistry Bloc (Gaseous State), Chemistry Olympiad Problems, Chemistry Musing Solution Set-17, Crossword
FEBRUARY	—	AIPMT Special, JEE Main, CBSE Board Chapterwise Series-9, Score High in CBSE Board (Physical Chemistry) (2015)	—	Unit-8 : Biomolecules, Polymers, Chemistry in Everyday Life	Surface Chemistry	Chemistry Musing Problem Set-19, Concept Booster, Chemistry Musing Solution Set-18, You Asked, We Answered, Advanced Chemistry Bloc (Nuclear Chemistry), Chemistry Olympiad Problems, Crossword
MARCH	—	JEE Main (Full Length), AIPMT Special, CBSE Board (2015)	—	Unit-9 : Principles Related to Practical Chemistry	Classification of Elements and Periodicity in Properties	Chemistry Musing Problem Set-20, Concept Booster, Advanced Chemistry Bloc (Vapour Pressure and Solubility of Gases), Olympiad Problems for Practice, Chemistry Musing Solution Set-19, AIIMS Special (Assertion & Reason), You Asked, We Answered, Crossword
APRIL	CBSE Board	JEE Advanced, BITSAT, Target AIPMT (Full Length), AIIMS (2015)	—	—	Essentials of Chemistry Class XI	Chemistry Musing Problem Set-21, Olympiad Problems, Concept Booster, Advanced Chemistry Bloc (Thermodynamics), You Asked, We Answered, Chemistry Musing Solution Set-20, Crossword
MAY	JEE Main	JEE Advanced, JIPMER, AIIMS, Target PMTs, BITSAT (2015)	—	—	Essentials of Chemistry Class XII	Chemistry Musing Problem Set-22, Advanced Chemistry Bloc (Concept of Free Energy), NCERT Corner (Class XI-XII), Concept Booster, Chemistry Musing Solution Set-21, You Ask, We Answer, Olympiad Problems, Crossword
JUNE	AIPMT, Kerala PMT, WB-JEE	Ace Your Way CBSE XII Chapterwise Series -1 (2016)	—	—	Some Basic Concepts of Chemistry	Chemistry Musing Problem Set-23, NCERT Corner (Class XI-XII), Learn Fast (Electron Displacements in Organic Compounds), Advanced Chemistry Bloc (Ideal Solutions), 50 Challenging Problems, Concept Booster, Chemistry Musing Solution Set-22, You Ask, We Answer, Olympiad Problems, Crossword
JULY	JEE Advanced, Karnataka CET	Ace Your Way CBSE XII Chapterwise Series-2 (2016)	Some Basic Concepts of Chemistry, Structure of Atom (Class XI); The Solid State, Solutions (Class XII)	Unit-1: Some Basic Concepts in Chemistry, States of Matter, Atomic Structure, Chemical Bonding and Molecular Structure	Physical Chemistry (Part-I)	Chemistry Musing Problem Set-24, Advanced Chemistry Bloc (Band Theory), You Ask, We Answer, Chemistry Musing Solution Set-23, Crossword
AUGUST	AMU Engg.	Ace Your Way CBSE XII Chapterwise Series-3 (2016)	Classification of Elements and Periodicity in Properties, Chemical Bonding and Molecular Structure (Class XI); Electrochemistry, Chemical Kinetics (Class XII)	Unit-2: Chemical Thermodynamics, Solutions, Equilibrium	States of Matter	MTG Makes It Happen, Chemistry Musing Problem Set-25, Olympiad Problems, Concept Booster, Chemistry Musing Solution Set-24, Advanced Chemistry Bloc (Contraction and Expansion of Orbitals), You Ask, We Answer, Crossword
SEPTEMBER	AIPMT Re-Exam	Ace Your Way CBSE XI Chapterwise Series-1, Ace Your Way CBSE XII Chapterwise Series-4 (2016)	States of Matter, Thermodynamics (Class XI); Surface Chemistry, General Principles and Processes of Isolation of Elements (Class XII)	Unit-3: Redox Reactions and Electrochemistry, Chemical Kinetics, Surface Chemistry	Chemical Bonding and Molecular Structure	Chemistry Musing Problem Set-26, Concept Booster, Chemistry Musing Solution Set-25, Advanced Chemistry Bloc (Metals and Metallurgy), You Ask, We Answer, Olympiad Problems, Crossword
OCTOBER	Bihar CECE	Ace Your Way CBSE XI Chapterwise Series-2, Ace Your Way CBSE XII Chapterwise Series-5 (2016)	Equilibrium, Redox Reactions (Class XI); The *p*-Block Elements, The *d*-and *f*-Block Elements (Class XII)	Unit-4: Classification of Elements and Periodicity in Properties, General Principles and Processes of Isolation of Metals, Hydrogen, *s*-Block Elements, *p*-Block Elements (Group 13 and 14)	General Organic Chemistry (Isomerism and Electron Displacement Effects)	Chemistry Musing Problem Set-27, Olympiad Problems, You Ask, We Answer, Advanced Chemistry Bloc (Stability of Complexes), Concept Booster, Chemistry Musing Solution Set-26, Crossword
NOVEMBER	—	Ace Your Way CBSE XI Chapterwise Series-3, Ace Your Way CBSE XII Chapterwise Series-6 (2016)	Hydrogen, *s*-Block Elements (Class XI); Coordination Compounds, Haloalkanes and Haloarenes (Class XII)	Unit-5: *p*-Block Elements (Group 15 to 18), *d*-and *f*-Block Elements, Coordination Compounds, Environmental Chemistry	General Organic Chemistry (Types of Organic Reactions and Methods of Purification of Organic Compounds)	Chemistry Musing Problem Set-28, Concept Booster, Advanced Chemistry Bloc (Organic Chemistry-Basic Reactions of Alkenes), Olympiad Problems, Learn Fast (Nomenclature of Organic Compounds), Chemistry Musing Solution Set-27, You Ask, We Answer, Crossword
DECEMBER	—	PMT (Class XI), Ace Your Way CBSE XI Chapterwise Series-4, Ace Your Way CBSE XII Chapterwise Series-7 (2016)	*p*-Block Elements, Organic Chemistry-Some Basic Principles and Techniques (Class XI); Alcohols, Phenols and Ethers, Aldehydes, Ketones and Carboxylic Acids (Class XII)	Unit-6: Purification and Characterisation of Organic Compounds, Some Basic Principles of Organic Chemistry, Hydrocarbons, Organic Compounds Containing Halogens	Structure of Atom	Chemistry Musing Problem Set-29, Advanced Chemistry Bloc (Oxidation States of *d*-Block Elements and Lanthanides), Chemistry Musing Solution Set-28, You Ask, We Answer, Crossword

CROSS WORD

Readers can send their responses at editor@mtg.in or post us with complete address by 25th of every month to win exciting prizes. Winners' name with their valuable feedback will be published in next issue.

ACROSS

2. The tendency of gasoline and other diesel fuels to produce knocking. (11)

5. A prism cut from a calcite crystal which is used to polarise the light. (10)

7. The macrocyclic polyethers. (11)

9. A graphical representation of the physical states in which a substance will exist under given conditions of temperature and pressure. (12)

11. The solid obtained directly by condensation of vapours without formation of any liquid. (9)

13. A compound found in the bark of willow trees. (7)

14. A complex formed in nucleophilic aromatic substitution by addition – elimination of aryl halides. (12)

15. Cyclic compounds having an element other than carbon present in the ring. (12)

18. The open hearth process was invented by _____ . (17)

19. The reaction in which tertiary amine oxides undergo elimination of a dialkylhydroxylamine on heating. (15)

21. The blue, purple, red or yellow compounds formed by heating Na_2WO_3 with W metal. (15)

23. The cell in which cathode has a lower potential than the anode. (8)

24. A compound containing water of crystallisation. (7)

25. A substance that exhibits luminescence or phosphorescence. (8)

26. A state of low level of blood sugar in the human biological system. (12)

27. An instrument used to examine various wavelengths present in electromagnetic radiation. (12)

DOWN

1. Graphs showing the variation of properties at constant pressure. (7)

3. A drug used in controlling Parkinson's disease. (12)

4. The alcohol obtained by the hydrolysis of a glycoside. (8)

6. Acidic dye obtained by coupling diazotised sulphanilic acid with dimethylaniline. (12)

8. A supercritical gas used in supercritical fluid chromatography. (13)

10. Another name of coenzyme Q. (10)

12. An α-helical globular protein that stores oxygen in the muscle tissues. (9)

13. A sediment formed by rock disintegration. (4)

16. A cubic cell having only one equivalent point. (9)

17. A toxic alkaloid found in tobacco that makes smoking habit forming. (8)

20. Non-heme iron containing protein. (10)

22. Potassium aluminosilicate found in a primary constituent of volcanic rocks. (7)

Cut Here